Predictors and Correlates of Adolescent Non-Suicidal Self-Injury

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Declaration

This dissertation is the result of my own work and includes nothing that is the outcome of work done in collaboration except as specified in the text.

It is not substantially the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or other qualification at the University of Cambridge or any other University or similar institution. I further state that no substantial part of my dissertation has already been submitted, or, is being concurrently submitted for any such degree, diploma or other qualification at the University of Cambridge or any other University or similar institution.

The text (excluding references, tables, figures and appendices) does not exceed 60,000 words.

Abstract

Non-suicidal self-injury (NSSI) is a dangerous and common behaviour, particularly among adolescents. Childhood trauma, insecure child-parent attachment, psychological distress, and impulsivity are some of the risk factors for NSSI that have been previously identified. However, the pathways from distal risk factors to NSSI and the ways in which these correlated risk factors interact with each other remains unclear. Identifying these pathways will provide valuable insight into the aetiology of NSSI and potentially highlight targets for treatment and intervention. In this dissertation I examine data from multiple large samples of young people, looking at multiple risk and protective factors together, and examining moderation and mediation pathways between risk factors.

Using longitudinal data from 933 adolescents with no prior history of NSSI I demonstrated that the association between childhood family adversity before age 5 and new onset of NSSI between the ages of 14 and 17 was mediated by age 14 family functioning and possibly mental illness.

Next, I validated a new measure of child perceptions of positive parenting, which I used to demonstrate the uni-directional prospective association between positive parenting and lower rates of NSSI amongst 1489 adolescents (ages 14-25). I then used this new measure of positive parenting to demonstrate that the prospective parenting-NSSI association was mediated by psychological distress. This is also one of the first prospective studies to show that impulsivity is independently predictive of NSSI.

Using data I collected myself from a sample of 596 adolescents (ages 16-19) I validated a much needed measure of childhood trauma, with which I then demonstrated that the trauma-NSSI association was mediated by attachment and distress. Using data from this sample I was also able to reaffirm my previous findings that the attachment-NSSI

association was mediated by psychological distress, and that impulsivity was uniquely associated with NSSI.

Finally, using data from a sample of 559 Flemish 13 year-olds, I demonstrated that behavioural problems were more salient to NSSI than emotional problems among young adolescents, and that the attachment-NSSI association might be mediated by hyperactivity and conduct problems.

Together, these findings reaffirm that childhood trauma, insecure child-parent attachment, psychological distress, and impulsivity are robust risk factors for NSSI and potential targets for treatment and intervention. Moreover, both distress and child-parent attachment may be viable targets for interventions aimed at attenuating the impact of early childhood trauma after it has occurred. Future research should use randomised controlled trails to test the efficacy of NSSI treatments aimed at these risk factors.

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Contents

Chapter 1

Non-suicidal self-injury

Non-suicidal self-injury (NSSI), defined as "*deliberate and voluntary physical self-injury that is not life-threatening and is without any conscious suicidal intent*" (Laye-Gindhu & Schonert-Reichl, 2005), is both a serious problem, and a common one.

1.1 What is NSSI?

Adolescents engage not only in more obvious forms of NSSI such as cutting, biting, scratching, and burning, but adolescents also sometimes consider methods such as non-suicidal pill-overdose, self-hitting, head banging, recklessness, and eating disordered behaviours to be NSSI (Laye-Gindhu & Schonert-Reichl, 2005). Cutting is the most common form of NSSI, followed by hitting and poisoning (including medication). Girls are more likely to engage in cutting, whereas boys may be more likely to engage in punching oneself or other objects, breaking bones, and risk taking behaviours (B. Taylor, 2003).

There has been some debate over whether a distinction should be made between 'suicidal' and 'non-suicidal' self-injury (Kapur, Cooper, O'Connor, & Hawton, 2013). Some researchers point to the greatly elevated risk for suicide among those who engage in NSSI as evidence that the two behaviours are not meaningfully different, however there is an elevated risk for suicide in nearly all psychiatric disorders (Harris & Barraclough, 1997). While the association between suicide and other disorders may not be as strong as it is for NSSI, high comorbidity does not mean the behaviours are synonymous. Substance abuse and eating disorders, for example, are both associated with significantly increased risk of suicide as well as accidental death (Harris & Barraclough, 1998). Moreover, overdose and starvation, two extreme forms of substance abuse and eating disorder behaviour respectively, are two potential methods of suicide. Yet despite the comorbidity and behavioural similarities with suicide, few if any researchers or clinicians would argue that either substance abuse or eating disorder behaviours are fundamentally the same as suicide attempts, even when these behaviours unintentionally result in death. The difference is in the motivational pathways behind the behaviours.

Like substance abuse and eating disorders, NSSI usually stems from different motivations and is related to different psychological features than suicide and should therefore be considered distinct. Firstly, there is a fundamental definitional difference in the desired result of NSSI and attempted suicide, namely, death. The majority of people who engage in NSSI never make a suicide attempt (81% according to Plener, Libal, Keller, Fegert, &

Muehlenkamp, 2009) and less than 1% of individuals reported suicidal intent as a main motivating factor for engaging in self-harm (Rodham, Hawton, & Evans, 2004). Qualitative studies demonstrate that people even report using NSSI as a means of suicide avoidance (by reducing the distressing affect which they fear may lead to suicide) and explicitly distinguish between the two actions (T. B. Brown & Kimball, 2013; Solomon & Farrand, 1996).

Although one paper did demonstrate that suicidality varied along a continuous distribution (Kapur et al., 2013), leading the authors to conclude that NSSI does not represent a distinct psychopathological phenomenon, the sample on which these analyses were based was derived from patients presenting to hospital. As the vast majority (87%) of NSSI goes untreated (Hawton, Rodham, Evans, & Weatherall, 2002), findings derived from hospital samples cannot be generalised to the broader population of people who engage in NSSI. Further, there appears to be a unidirectional association between NSSI and suicide, in which NSSI predicts suicide attempts, but suicide attempts do not predict NSSI (Asarnow et al., 2011; P. O. Wilkinson, Kelvin, Roberts, Dubicka, & Goodyer, 2011). This is at odds with the suggestion that both NSSI and suicide attempts are different manifestations of the same spectrum of behaviour, in which case we would expect a bidirectional relationship as individuals' symptoms fluctuate.

NSSI and suicide attempts differ in several other respects as well, such as degree of planning. Many people who engage in NSSI do so after only a few minutes of considering it, generally after little planning or consideration of consequences, particularly if NSSI is a highly repeated and habitual behaviour (Nock & Prinstein, 2005). Conversely, suicide attempts are more likely to be preceded by careful planning, particularly where suicidal intent is high. There are, moreover, a number of ways in which people making suicide attempts differ from those engaging in NSSI only: people who engage in suicide attempts are typically more impulsive (Dougherty et al., 2009; Liu, Trout, Hernandez, Cheek, & Gerlus, 2017), are more likely to have a psychiatric diagnosis or a family history of psychiatric illness, and show different neurobiology from people who engage in NSSI alone (Groschwitz & Plener, 2012). Further, NSSI and suicidality have different associations with other psychiatric disorders: adolescents who

attempt suicide are more likely than those who only engage in NSSI to have symptoms of depression and anxiety (Mars, Heron, Crane, Hawton, Kidger, et al., 2014), and concurrent clinical diagnosis of depression or post-traumatic stress disorder, whereas those who only engage in NSSI are more likely to have features of borderline personality disorder (Jacobson, Muehlenkamp, Miller, & Turner, 2008). A large study of 10,678 twins (mean age = 32.76, SD = 6.99) found that suicide ideation and NSSI had shared genetic antecedents that accounted for much (76% for men and 62% for women) of the correlation between these two phenomena (r = 0.49 for men, 0.61 for women). It concluded that environmental factors accounted for much of the differences (Maciejewski et al., 2014). These differences, both philosophic and empirical, between suicidal behaviour and NSSI support the specific and distinct assessment and study of NSSI.

1.2 Assessment of NSSI

The heterogeneity of NSSI, how it is defined, and the ways in which it is measured has likely resulted in inconsistencies across the field (Swannell et al, 2014). Indeed, very few studies have used psychometrically validated instruments in their assessment of NSSI (Fliege, et al., 2009). It is also important to note that different psychological and motivational profiles have been found among people who engage in different types of NSSI. Data from 6,020 students ages 15 and 16 showed that overdosing is related to higher suicidality than cutting, whereas cutting is more likely to be engaged in impulsively than overdosing (Rodham et al., 2004). As such, distinguishing between forms of NSSI may have significant prognostic and clinical implications. Moreover, as girls tend to engage in more traditionally-recognised forms of NSSI (e.g. cutting, overdosing) than boys, who engage in more male-type NSSI (e.g. head banging, punching) (B. Taylor, 2003), it is imperative that a broad definition of NSSI be used in research lest certain groups, such as males, be underestimated or wholly overlooked (Swannell, Martin, Page, Hasking, & St John, 2014). It is also important that controversies around what is ‘NSSI’ are resolved, so research is more consistent.

The meta-analysis by Swannell (2014) found that methodological factors make a significant difference in reported rates of NSSI. Specifically, multiple item checklists of NSSI behaviours yield higher rates than single yes/no items about presence or absence of engagement of NSSI. Swannell suggests that this is likely because participants are more likely to recall engaging in behaviours when asked about them specifically than when asked a more general question. Nevertheless, using a single-item measure of NSSI is common in NSSI research and has previously been shown to render consistent estimates of prevalence (Muehlenkamp, Claes, Havertape, & Plener, 2012).

Swannell also notes that higher and presumably more accurate rates of reported NSSI are also obtained when anonymous and self-administered questionnaires are used than when participants are potentially or explicitly identifiable, or when studies are interview based. These differences are likely due to socially desirable under-reporting of NSSI, which is a sensitive and stigmatized subject. As such, self-report surveys of NSSI should be as anonymous and private as possible to encourage accurate responding. Finally, Swanell advises that participants should be asked about the severity and frequency of their NSSI, as this may be an important prognostic indicator**.**

Self-report measures are not only the most accurate in terms of NSSI assessment of NSSI, but also seem to demonstrate the strongest association with NSSI in regards to other risk factors. Previous studies have found poor agreement between parent and child ratings of child psychological wellbeing (Kazdin, French, Unis, Alan, & Esveldt-Dawson, 1983), family relationships (Caster, Inderbitzen, & Hope, 1999), and NSSI (Meltzer, Harrington, Goodman, & Jenkins, 1999; Sourander et al., 2006). Adolescents' perceptions of themselves and their relationships with others appear to be significantly more closely related to their NSSI behaviour than are their parents' perceptions (Resch, Parzer, & Brunner, 2008; Steinhausen, Bosiger, & Metzke, 2006). Likewise, in regards to possible observational or behavioural measures, adolescents' confidence and security in their relationships with their parents appear to be more important for psychological well-being than is their actual reliance on parents for support (Paterson, Pryor, & Field, 1995). Retrospective self-report measures of trauma have also been found to be accurate

(Kubany et al., 2000). Therefore, throughout this thesis I have relied almost completely on self-report measures, not only of NSSI, but also of other possible aetiological factors.

Finally, it is worth noting that several studies have demonstrated that asking about NSSI or about specific NSSI behaviours is not significantly distressing and does not increase the likelihood of participants going on to engage in those behaviours, and may actually reduce these behaviours among those at high-risk (Muehlenkamp, Walsh, & McDade, 2010). Thus there is no inherent ethical issue in asking adolescents about NSSI. However, important consideration is needed as to how researchers act and advise participants who reveal NSSI, balancing a duty of care with the duty of confidentiality.

1.3 Epidemiology

According to an international study of the epidemiology of NSSI, just over a quarter of adolescents (26%) have engaged in NSSI at least once in their lives, and nearly a tenth (9.5%) have engaged in NSSI at least 4 times (Plener et al., 2009). A recent meta-analysis of 119 studies published between 1993 and 2013, comprising data from 231,553 respondents, revealed similar, although somewhat lower numbers: NSSI prevalence across studies was found to be 17% among adolescents (aged 10-17), 13% among young adults (18-24), and 5.5% among adults (aged ≥ 25) (Swannell et al., 2014). This meta-analysis also found no significant increase in prevalence of NSSI over the past two decades, nor do there seem to be different rates globally across developed regions including Asia, Australia and New Zealand, Europe, the United Kingdom, Canada, and the USA. Moreover, NSSI was not significantly more common among females (21.3%) than males (17.8%) after adjusting for methodological factors. Rates of NSSI are not only highest among adolescents (Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007; Moran et al., 2012; Nock, 2010), but this is also the most common time of first incidence (Nixon, Cloutier, & Jansson, 2008).

1.4 An adolescent disorder

There are many probable reasons why NSSI is particularly prevalent in adolescence. Adolescence is a tumultuous phase during which young people are undergoing significant social, physiological, and psychological changes. Social structures and expectations are rapidly changing; as teens try to establish their independence and autonomy (Steinberg, 1999) they begin to rely less on parents and more on peers (Buhrmester & Duane, 1998). During this transition adolescents may find themselves without stable sources of social support. Also during this time neurotransmitter levels and functionality are in flux (Takeuchi et al., 2000), while the prefrontal cortex, responsible for problem solving (Spear, 2000) and behavioural inhibition (Ridderinkhof, van den Wildenberg, Segalowitz, & Carter, 2004) is still developing. Moreover, as the limbic system, responsible for emotion response, matures before the prefrontal cortex, which is responsible for cognitive and emotion regulation, adolescents may experience intense and poorly regulated emotions (Hagan et al., 2015). Considering these neurodevelopmental changes alongside hormonal imbalances associated with puberty (Reardon, Leen-Feldner, & Hayward, 2009), it is no wonder that adolescence is associated with high rates of not only NSSI but also a number of other psychological and behavioural problems, such as depression (Thapar, Collishaw, Pine, & Thapar, 2012), anxiety disorders (Kashani & Orvaschel, 1990), substance misuse (Weinberg, Rahdert, Colliver, & Glantz, 1998), eating disorders (Gonzalez, Kohn, & Clarke, 2007), risky sexual behaviour (Metzler, Noell, Biglan, Ary, & Smolkowski, 1994; Romer & Stanton, 2003), and antisocial, criminal, and otherwise reckless behaviour (Arnett, 1992), which are all in turn associated with NSSI (Hawton et al., 2002; Kessler et al., 1999).

In support of the idea that the aforementioned physiological changes contribute to the high rates of NSSI observed in adolescence, data from 3,332 Australian adolescents ages 12-16 showed that the risk for NSSI is closely linked to pubertal development, independent of age (G. C. Patton et al., 2007). This association was largely mediated by the higher rates of depressive symptoms, substance use, and sexual activity that accompany pubertal maturation. This study also showed that after controlling for pubertal stage, age was inversely related to rates of NSSI. Thus, growing older is associated with a

decline in rates of NSSI, possibly for any of the reasons discussed in this section such as cortical development or changing social pressures; however this effect is masked during early adolescence by the more pronounced risk for NSSI conferred by pubertal development.

As NSSI is exacerbated by the social and physiological changes inherent to adolescence, it is unsurprising that NSSI is primarily an adolescent disorder. Data from nearly 2000 Australian adolescents followed for over 13 years (from average age 16 to 29) showed that 90% of cases of adolescent NSSI subside in the relative stability of adulthood (Moran et al., 2012). Finally, NSSI may be more socially acceptable in adolescence than in adulthood, possibly because adulthood is associated with more responsibilities with which NSSI might interfere, greater emphasis on mature responses to distress, and greater consequences of NSSI, such as employment difficulties resulting from visible scars or other wounds.

1.5 Prognosis

As well as causing physical harm, adolescent NSSI is associated with a number of negative outcomes, such as greater consumption of cigarettes, alcohol, and drugs (Hawton et al., 2002), emotional problems, antisocial behaviour, low self-esteem, and increased risk taking behaviour (Laye-Gindhu & Schonert-Reichl, 2005). Even sporadic (no more than once per year) NSSI in adolescence significantly increases the risk of later development of anxiety and depression (P. O. Wilkinson, Qui, Neufeld, Jones, & Goodyer, 2017). This association, moreover, remained when common risk factors were controlled for, indicating NSSI may have a direct effect on subsequent development of psychopathology. Adolescent NSSI has been robustly linked to subsequent development of mental illness (Mars, Heron, Crane, Hawton, Lewis, et al., 2014), and is perhaps the strongest predictor of future suicide attempts, even more so than a history of former suicide attempts (Asarnow et al., 2011; Franklin et al., 2017; Ribeiro et al., 2016; P. O. Wilkinson et al., 2011). This association between NSSI and future suicide attempt remained significant even when other potential confounds at baseline, such as suicidality,

gender, depression, and family dysfunction, were controlled for. A large follow-up study of people of all ages presenting to hospital with self-harm found they were at greatly increased risk of future suicide regardless of level of suicidal intent (J. Cooper et al., 2005). Evidence from a long-term follow-up study of 11,583 self-harm (both suicidal and non-suicidal) patients from the UK shows that repeated self-harm attempts put people at greater risk of suicide than single or sporadic episodes, with mortality rates by suicide over 15 years 4.7% among repeated self-harmers compared to 1.9% among those reporting only a single-episode (Zahl, 2004). Results from the same sample showed, moreover, that risk of suicide was highest immediately following incidents of self-harm, and that risk of suicide increased with age of first incident. The risk of suicide among 10–24 year old participants reporting self-harm was 35 times greater than the general population for men and 75 times greater for women (Hawton, Zahl, & Weatherall, 2003).

NSSI can be addictive (Nixon, Cloutier, & Aggarwal, 2002; Daphne Simeon & Favazza, 2001), socially contagious (Taiminen, Kallio-Soukainen, Nokso-Koivisto, Kaljonen, & Helenius, 1998), and may escalate over time (Hasking, Momeni, Swannell, & Chia, 2008). Longer continuation of NSSI is associated with greater severity, frequency, and variety of methods (Andrews, Martin, Hasking, & Page, 2013). Recurrent NSSI may result in habituation to the adverse effects of NSSI (i.e. physical damage and pain) and sensitization to its acute rewards (i.e. acute stress relief) (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). Thus, recurrent NSSI can lead to higher pain tolerance, reduced fear of death, and more dangerous acts of self-harm (Joiner, 2007), increasing the likelihood of accidental death or suicide (Van Orden et al., 2010). NSSI also presents a risk of scarring, infection, and other lasting physiological damage; it can have serious social consequences, leading to teasing and peer rejection, exclusion from school, and over-protective parenting; and can lead to negative feelings, including shame and guilt. This can result in a deteriorating cycle of impaired social relationships and negative emotions (P. O. Wilkinson, 2013). As such, it is imperative that NSSI is recognized and treated early (Hallab & Covic, 2010).

1.6 Treatment

NSSI is often overlooked and rarely treated, with less than 13% of reported cases among adolescents referred to a hospital (Hawton et al., 2002). Until recently, randomised control trials of treatments for NSSI were small and found few significant differences between treatment methods. Two large randomised controlled trials in depressed adolescents demonstrated that adding cognitive-behavioural therapy to selective serotonin reuptake inhibitor antidepressants led to a significant additional reduction in depressive symptoms, but no additional reduction in self-injury, whether suicidal and non-suicidal self-injury were classified together (March et al., 2004) or separately (Brent et al., 2009). To date, there has only been one study showing effective pharmacological treatment of NSSI specifically, which involved intramuscular injections of flupentixol, an old antipsychotic with many negative side effects (Montgomery & Montgomery, 1982). The sample of this study was small (n = 37) and it has not been replicated. As such, the NICE review concluded that there is insufficient evidence to support pharmacological treatment of self harm (NICE National Collaborating Centre for Mental Health (UK), 2012). There is also a risk of overdosing that should be considered when prescribing medication to patients with histories of NSSI or suicidality. Therefore, NICE guidelines recommend "offering 3 to 12 sessions of a psychological intervention that is specifically structured for people who self-harm, with the aim of reducing self-harm" (p. 289).

In a meta-analysis of 32 randomized controlled trials of various psychotherapeutic approaches to treating both suicide attempts and NSSI, only mentalization based therapy was found to be more effective than treatment as usual (Calati & Courtet, 2016). Mentalization is the understanding that people's actions are the product of thoughts and feelings. Improvements in mentalization have been associated with improved impulse control among people with affect regulation and impulsivity problems (Bateman & Fonagy, 1999). Poor mentalization may be a risk factor for NSSI through its associations with impulsivity, as well as negative cognition, social isolation, and depression (Bateman & Fonagy, 2008). Mentalization based therapy involves both individual and group sessions focused on improving mentalization through positive feedback and a supportive therapeutic relationship. Its efficacy was demonstrated on 38 borderline personality

(BPD) patients (Bateman & Fonagy, 1999) and 80 adolescents (85% female) who had presented to mental health service or emergency departments for self-harm (Rossouw & Fonagy, 2012). It is noteworthy that there was a high proportion of participants who met the criteria for BPD in this latter sample as well, and that in both samples the mentalization based therapy was more effective than treatment as usual in reducing not only NSSI, but also depressive and BPD symptoms. Thus, the efficacy of metallization based therapy on the large majority of people with NSSI who do not have BPD is unclear.

Another meta-analysis of 19 randomized controlled trials of therapeutic interventions for self-harm (both suicidal and non-suicidal) among adolescents, identified dialectical behavior therapy as having the largest treatment effect size (Ougrin, Tranah, Stahl, Moran, & Asarnow, 2015). Dialectical behaviour therapy focuses on improving mindfulness, distress tolerance and acceptance, emotion regulation, and interpersonal effectiveness. In a randomized control trial of 77 adolescents with recent and repetitive NSSI treated in outpatient clinics, dialectical behaviour therapy for adolescents was more effective than treatment as usual in reducing not only NSSI, but also suicidal ideation, and depressive symptoms (Mehlum et al., 2014).

Finally, interpersonal psychotherapy adolescent-intensive is a newly developed therapeutic approach focused on understanding and improving interpersonal problems related to the psychological symptoms being addressed. This therapy was shown to be more effective than treatment as usual in reducing suicidality, depression, and interpersonal problems in sample of 73 depressed students in Taiwan who were found to be at risk of suicide in initial screening (Tang, Jou, Ko, Huang, & Yen, 2009). Interpersonal psychotherapy adolescent-intensive was also more effective than treatment as usual in reducing NSSI among adolescents (personal communication between M Tang and P Wilkinson).

No studies on therapeutic approaches to treating adolescent NSSI have been replicated (Ougrin et al., 2015), and trials of both interpersonal psychotherapy adolescent-intensive and mentalization-based therapy have only been conducted by their respective inventors.

Moreover, most facilities are unable to offer these specific treatments, and such lengthy and intense treatment may not be feasible or acceptable to patients or treatment funders. To date, there is also no evidence to support pharmacological treatment of NSSI. As such, the most practical approach to treating NSSI may be to treat any underlying psychiatric illness, address environmental stressors, and provide a supportive and positive therapeutic environment. This general lack of effective treatments for NSSI may in large part be due to our poor understanding of what factors are associated with NSSI onset, continuation, and remittance. Hopefully further research and a better understanding of what factors are associated with the onset of NSSI in adolescence will help the development of more effective and specific treatments in the future.

1.7 Conclusion

NSSI is a serious and prevalent problem, particularly among adolescents. While the majority of cases of adolescent NSSI resolve on their own by adulthood, NSSI is associated with a number of adverse psychological, social, and physical outcomes, including mental illness, serious injury, and suicide. Despite this, there is limited evidence for specific treatments for NSSI, owing in part to a scant understanding of the aetiology of this behaviour. In this thesis I will use data from multiple large datasets to shed further light on the factors associated with adolescent NSSI, in the hopes of bettering our understanding of its aetiology and informing effective treatments of this behaviour in the future.

Chapter 2

Risk factors for NSSI

Given the prevalence, danger, and prognostic implications of NSSI among adolescents, discovering the aetiological and developmental processes of self-injurious pathways during this period is of paramount importance (Laye-Gindhu & Schonert-Reichl, 2005). In this chapter I will review several factors that have been implicated in the aetiology of NSSI, in particular psychological illness and distress (Nixon et al., 2008), trauma (Yates, Carlson, & Egeland, 2008), poor interpersonal relationships (Hallab & Covic, 2010; Lowenstein, 2005), and impulsivity (Hamza, Willoughby, & Heffer, 2015). While the link between some of these factors and NSSI seems evident, a minority of people who experience these risk factors actually go on to engage in NSSI. Thus there must be critical intermediary risk and/or protective factors relevant to the aetiology of NSSI. Little, however, is known about the mechanisms by which distal risk factors such as childhood trauma lead to NSSI in adolescence, or about the interactions between more proximal environmental and psychological risk factors (Lowenstein, 2005). Two recent reviews of NSSI aetiology research emphasised the need for models that that test interactions and mediations between multiple risk and protective factors together (Fliege, Lee, Grimm, & Klapp, 2009; Maniglio, 2011). It is my intention to do so in this thesis.

2.1 Moderation and mediation

Often, multiple variables confer independent additive effects upon the dependant variable (DV). In certain cases, however, the effect of one independent variable (IV) on the DV are influenced by some third variable. Two examples of this are mediation, and moderation. Mediation is the extent to which an IV is associated with the DV through the effect the IV has on some intermediary variable, or mediator, which in turn impacts the DV (Baron & Kenny, 1986). Thus, mediation represents a concatenation of contingent effects. Moderation, on the other hand, is when the association between IV and DV is either weakened or strengthened depending on an independently occurring secondary variable. Thus, in moderation the IV interacts multiplicatively with another independent variable, the moderator, in affecting DV (Whisman & McClelland, 2005). Throughout this thesis, moderation will be tested with multiplicative interaction terms, and 'interaction' will be taken to mean multiplicative effects.

While the distinction between moderation and mediation is apparently subtle, it has significant practical implications. Firstly, the temporal relationships of IVs with moderator and mediator variables is different. While changes in a mediator are dependent upon the IV and therefore must occur after the IV, moderator variables should be largely independent of the IV and can occur either before or concurrently to the IV. In a clinical sense, both moderators and mediators of the IV-DV, or in this case the risk-NSSI associations indicate potential areas of therapeutic intervention. However, whereas moderators indicate ways to pre-emptively protect against the impact of distal risk factors on NSSI, mediators indicate ways to reduce the risk conferred by risk factors after they have already occurred, as it is through these mediators that distal risk factors influence subsequent NSSI. Diagrams of mediation and moderation are shown in Figure 2.1.

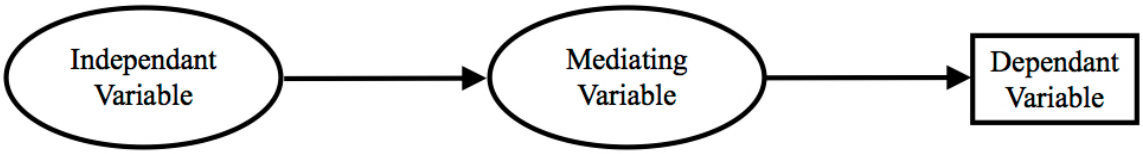


Figure 2.1a. An example of mediation; where the effect of the IV on the DV is facilitated by an intermediary variable, the MV.

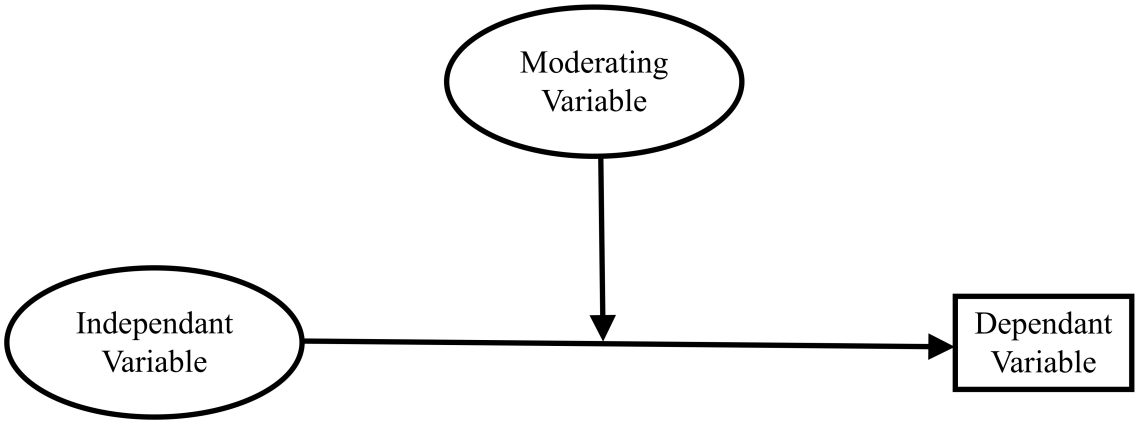


Figure 2.1b. An example of multiplicative moderation in which the effect of the IV on the DV is altered by a secondary independent moderating variable.

In some cases the relationship between various risk factors and NSSI seems clear. For example, in the following sections I shall discuss how childhood trauma often results in psychological distress, which may then be responded to with NSSI. Thus, distress could be said to act as a mediator of the trauma-NSSI association. However, while poor child-parent relationships may produce psychological distress (which mediates the effects of relationships on NSSI), distress could also arise from some unrelated source such as trauma. In this latter case, positive child-parent relationships could nevertheless influence whether psychological distress was associated with NSSI, for example children with better relationships with their parents may speak to their parents and receive useful support; while children with poorer relationships may be more likely to self-harm as parental support is not so available/helpful (moderation). In such case where the theoretical distinction between mediation and moderation is unclear, it is important to test for both, even in the absence of an overall main effect, as moderation effects in opposite directions could mask an overall main effect. Below I shall discuss how proposed risk factors may be associated with NSSI both directly, and through mediation and moderation pathways with other risk factors and protective factors.

2.2 Psychological illness / distress and NSSI

Two of the primary reasons given for engaging in NSSI are to alleviate distress and to communicate distress to others (Klonsky, 2007). While these motivations serve intrapersonal and interpersonal functions respectively, they highlight the fact that distress is central to aetiology of NSSI. Although NSSI is often present in people without a formally-diagnosable mental illness, it is still generally a response to psychological distress (Nixon et al., 2008). NSSI occurs in the context of a broad range of negative emotions, including depressed mood (Levy, 2005), anxiety (Irons & Gilbert, 2005), stress (Richmond, Hasking, & Meaney, 2017), and low self-esteem (De Leo & Heller, 2004). Indeed, NSSI should be seen as a transdiagnostic behaviour, caused by the confluence of both psychological distress (which may or may not be part of a psychiatric 'illness') and a propensity to self-harm when distressed. Other risk factors, discussed below, contribute to this propensity. Higher rates of NSSI are associated with nearly all psychiatric disorders (Kessler et al., 1999; Nock & Kessler, 2006), however NSSI is particularly prevalent among patients with depression, anxiety, eating disorders, and BPD (Andover, Pepper, Ryabchenko, Orrico, & Gibb, 2005).

2.2.1 Depression and anxiety

The link between depressed affect and NSSI is well-demonstrated and unsurprising (Blair-West, Cantor, Mellsop, & Eyeson-Annan, 1999; Nixon et al., 2008). People who engage in NSSI are significantly more likely to suffer from depressive symptoms and suicidality than even other clinical populations (Selby, Bender, Gordon, Nock, & Joiner, 2012). Likewise, childhood anxiety disorders have been robustly associated with subsequent NSSI (Hawton et al., 2002; Moran et al., 2012; O'Connor, Rasmussen, Miles, & Hawton, 2009; Selby et al., 2012).

2.2.2 Borderline personality disorder

A recent review of NSSI concluded that it is engaged in by between 48–79% of individuals with BPD (Chapman, Gratz, & Brown, 2006). The same review suggests that these particularly high rates of NSSI are unsurprising given BPD is characterized by

extremely insecure attachment styles (Bartholomew, Kwong, & Hart, 2001), as well as intense and unstable emotions from which NSSI may be a means of relief. Moreover, the high overlap of NSSI and BPD may be due in part to similar risk factors: childhood traumatic experiences such as physical and sexual abuse, and family dysfunction have been robustly linked to both NSSI and BPD (Gratz, 2003; Helgeland & Torgersen, 2004).

BPD is the only DSM-IV psychiatric diagnosis for which NSSI is a criterion (American Psychiatric Association, 2015), which may incorrectly lead some clinicians to assume that any patient with NSSI has BPD. Engaging in NSSI is not, however, synonymous with BPD. Firstly**,** the prevalence of BPD is approximately 1%–2% in the general population (Torgersen, Kringlen, & Cramer, 2001), which is significantly lower than the prevalence of NSSI among both the general population and adolescents (for further details on the epidemiology of NSSI, see Section 1.1). Moreover, NSSI is often present in patients with psychiatric disorders other than BPD, as well as in people who do not meet the diagnostic criteria for any mental illness. Finally, many clinicians believe it is inappropriate to give a diagnosis of any personality disorder to young people aged under 16/17, as their personalities are still developing (World Health Organization, 1992). Thus, the majority of adolescent NSSI happens among people without a diagnosis of BPD.

2.2.3 Eating disorders

NSSI is also particularly prevalent among people with eating disorders (Portzky, Wilde, & Heeringen, 2008). A study of Medline and PsycINFO databases indicated that approximately one quarter of eating disorder patients engage in NSSI (Sansone & Levitt, 2002). As with BPD, this high comorbidity between NSSI and eating disorders may be in large part due to the shared antecedents of both behaviours. Like NSSI, eating disorders are associated with traumatic childhood experiences, impaired attachment, dissociation (Farber, 2008), and impulse control problems (Waxman, 2009). Moreover, in some instances eating disorder behaviour may actually be a form of NSSI, and is sometimes considered as such by adolescents (Laye-Gindhu & Schonert-Reichl, 2005). It is my opinion that the distinction between eating disorder and NSSI lies in the motivation and

not the behaviour: when an adolescent is starving themselves with the intention of losing weight the behaviour may be anorectic, however when an adolescent makes themselves purge or skip a meal as a punishment, the behaviour may be NSSI. The distinction is sometimes difficult to make and is often blurred, however it may have important treatment implications: emphasising the harmfulness of starvation behaviour may help convince an eating disorder patient to stop, whereas it could actually reinforce someone engaging in the same behaviour as NSSI. This theory, however, has yet to be tested.

2.2.4 Affective instability

Affective instability (Koenigsberg et al., 2001) and reactivity (Gratz, 2006) have been linked to NSSI, with some studies even finding that emotional dysregulation and variability are predictive of NSSI regardless of the valence of those emotions (Claes, Houben, Vandereycken, Bijttebier, & Muehlenkamp, 2010; Klonsky, 2009). People who engage in NSSI often have problems with both regulating emotional responses and tolerating intense emotions (Gratz & Roemer, 2008; Klonsky, 2007). Poor emotion regulation is related to continuing to engage in NSSI one year later (Andrews et al., 2013), and adolescents who engage in NSSI experience both greater physiological arousal to, and lower tolerance of, distress (Nock & Mendes, 2008). This means that people who engage in NSSI are at the same time more likely to experience distress (Selby et al., 2012) and less able to tolerate it (Gratz & Roemer, 2008; Klonsky, 2007). For these people, extreme affect may override behavioural controls and NSSI may be an effective means of diminishing aversive symptoms by regulating this distress. Indeed, NSSI is often immediately preceded by distress and followed by temporary relief (Klonsky, 2007; Nock, Prinstein, & Sterba, 2009). Getting relief from these overwhelming or intolerable emotions is frequently cited as one of the primary reasons for why people engage in NSSI (Claes et al., 2010; Klonsky, 2009; Nock & Prinstein, 2004).

2.2.5 General-specific models of distress

Symptoms of psychiatric illness are often highly correlated, making it difficult to draw conclusions from traditional regression models that include all dimensions of psychiatric wellbeing or illness as distinct variables. In general-specific, or bi-factor models, the

shared variance of correlated measures is subsumed by one general factor, and the remaining unique variance is partitioned into a specified number of separate oblique specific factors. Previous research has shown that bi-factor models often fit symptom-level data better than alternative models (Brodbeck, Abbott, Goodyer, & Croudace, 2011; Simms, Grös, Watson, & O'Hara, 2008; Simms, Prisciandaro, Krueger, & Goldberg, 2012; Thomas, 2012), particularly when symptoms are present in a number of disorders. In several of my studies, therefore, I have used multi instrument bi-factor models of distress, as well as of other correlated risk factors for NSSI. Where I derived these bi-factor models myself, I will report the methodology and validation of the model. Where these bi-factor models were derived by other members of my research group, I shall specify this.

2.3 Trauma and NSSI

Traumatic experiences are not uncommon during childhood and adolescence (Berger, Knutson, Mehm, & Perkins, 1988) and are associated with a broad range of NSSI-related negative developmental outcomes, such as substance abuse (Heffernan et al., 2000), eating disorders (Smolak & Murnen, 2002), depression, and suicide attempts (J. Brown, Cohen, Johnson, & Smailes, 1999). Moreover, trauma in the forms of sexual (Murray, Macdonald, & Fox, 2008) and physical abuse (Yates, Tracy, & Luthar, 2008), have been robustly associated with NSSI among both adolescents (Sandberg, Rutter, Pickles, McGuinness, & Angold, 2001; Tyler, Whitbeck, Hoyt, & Johnson, 2003), and adults (G. W. Brown, Harris, & Hepworth, 1994; Kendler et al., 2010). The pathways from these distal risk-conferring events to actual manifestation of NSSI up to two decades later, however, remain unclear.

2.3.1 Trauma and distress - mediation

One of the ways in which childhood trauma may predispose individuals to engage in NSSI during adolescence is through its role as a risk factor in the onset of psychological distress and psychiatric illness. There is a well demonstrated casual link between

traumatic events and psychological distress (Dunn et al., 2011; Fergusson, Boden, & Horwood, 2008; van Harmelen et al., 2016). Negative life events frequently precede adolescent onset of psychological disorders (Sandberg et al., 2001), and both acute and long-term environmental traumas are associated with increased rates of psychiatric disorders among young people (Ian M. Goodyer, Cooper, Vize, & Ashby, 1993; Ian M. Goodyer, Wright, & Altham, 1990; Sandberg, McGuinness, Hillary, & Rutter, 1998). A review of literature on the impact of adverse life events found that higher numbers of negative life events were not only associated with the onset of psychopathology, but were also associated with poorer outcomes and greater chances of relapse (Paykel, 1994). Moreover, different types of adverse experiences often co-occur and are cumulatively negatively impactful on wellbeing (Dube et al., 2001; Dube, Anda, Felitti, Edwards, & Croft, 2002). Childhood adversity may disrupt the development of stress response systems in the brain, leading to problems with emotion processing and regulation later in life (Perry & Pollard, 1998; P. O. Wilkinson & Goodyer, 2011).

As discussed above, a range of types of emotional distress may lead to NSSI. Self-punishment is one commonly noted motivation for engaging in NSSI (T. B. Brown & Kimball, 2013; Laye-Gindhu & Schonert-Reichl, 2005). Many victims of child abuse struggle with profound feelings of guilt (Wolfe, Sas, & Wekerle, 1994), and self-blame for acts of abuse has been linked with greater psychopathology, including depression, among victims (Cascardi & O'Leary, 1992; Lange et al., 1999). As such, some cases of NSSI may be forms of self-punishment in response to feelings of guilt associated with trauma. Thus, NSSI may be a reaction to the continued and more proximal psychological distress resulting from childhood trauma (Figure 2.2).

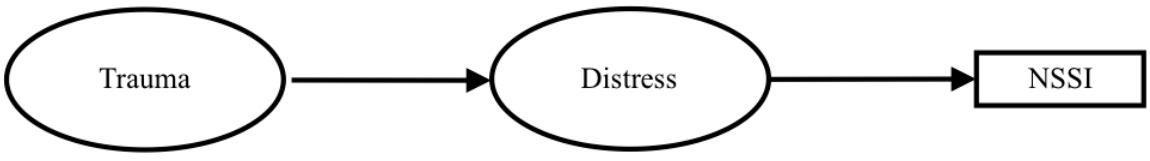


Figure 2.2. Distress may mediate the association between trauma and NSSI.

2.4 Interpersonal relationships and NSSI

Lack of social support predicted engagement in NSSI in a 2.5-year longitudinal study of adolescents (Hankin & Abela, 2011), and in cross-sectional studies lack of social support has been associated with continuing NSSI and severity (Muehlenkamp, Brausch, Quigley, & Whitlock, 2013; S. Stanford & Jones, 2009). Likewise, strong social support is also an important factor in NSSI cessation (Rotolone & Martin, 2012). Adolescents' primary sources of social support are parents and peers (Gottlieb, 1991). A longitudinal study of nearly 2000 Australian adolescents found that family support and lack thereof were among the strongest predictors of new onset and cessation of NSSI respectively (Tatnell, Kelada, Hasking, & Martin, 2014). This strong influence of parent-child relationships may be explained in part by attachment theory.

2.4.1 Child-parent attachment

Attachment is a dyadic phenomenon, in which not only the behaviours of the child but also the responses and behaviours of the parent shape the bond between them (Bowlby, 2008). The fundamental concept of attachment centres on infants' perceptions of their parents' accessibility and responsiveness to their needs, demands, and communications such as crying (Bowlby, 1988a). Infants form schemas or working models of their self-worth and what can be expected of others on the basis of these early interactions. According to Mary Ainsworth, when parents respond appropriately and consistently to their children's needs and communications, their children form a schema in which others are reliable and caring and they themselves are valued, competent communicators, and worthy of receiving this care (Ainsworth, 1989). This is the ideal of secure attachment. When parents fail to do so, their children learn to think of themselves as unlovable, unworthy, and unable to attract adequate attention; and these children think of others as indifferent, cold, and unhelpful or unwilling to offer help, or else actively dangerous and harmful.

As these schemas of the self and other formed in the context of early attachment relationships inform the way in which later relationships and interactions are formed and perceived (Bowlby, 2008; Pallini, Baiocco, Schneider, Madigan, & Atkinson, 2014),

these working models are largely self-perpetuating and become increasingly well established as individuals grow older (Bretherton, 1985; Sroufe, Carlson, Levy, & Egeland, 1999). In this way, attachment is related to a broad range of social and developmental outcomes across the lifespan (Carlson & Sroufe, 1995; DeKlyen & Greenberg, 2008). Among adolescents, insecure attachment is related not only to NSSI (Di Pierro, Sarno, Perego, Gallucci, & Madeddu, 2012; Tatnell, Hasking, Newman, Taffe, & Martin, 2016; Tatnell et al., 2014; Yates, Tracy, et al., 2008), but also to numerous behaviours closely related to NSSI, such as substance abuse and risky sexual behaviour (M. L. Cooper, Shaver, & Collins, 1998; Howard & Medway, 2004), eating disorders (Ward, Ramsay, & Treasure, 2000), and delinquency (J. P. Allen et al., 2002). Conversely, secure attachment is associated with a number of positive social and emotional outcomes, such as more positive views of the self (Jude Cassidy, 1988; Collins & Read, 1990), less engagement in high-risk behaviours, enhanced social skills and coping strategies (Moretti & Peled, 2004), and fewer symptoms of depression and anxiety (Irons & Gilbert, 2005).

Although the theory of attachment centres on the idea that attachment schemas are relatively stable, they do change within and across relationships over time, and may be particularly volatile during adolescence (M. L. Cooper et al., 1998; E. Waters, Merrick, Treboux, Crowell, & Albersheim, 2000; Weinfield, Whaley, & Egeland, 2004). Attachment styles continue to adapt and transform in response to subsequent relational interactions and continual development (Sroufe & Rutter, 1984). As such, it is important that attachment styles close to the time of NSSI engagement be assessed as opposed to using retrospective attachment measures. Unfortunately, although recent family conflict has been implicated as a critical factor preceding adolescent engagement in NSSI (Lowenstein, 2005), the quality of the parent-child relationship, as it is perceived by the child near the time of their engaging in self-harm, has largely been ignored as a potentially critical etiological factor. Indeed, proximal stressors in relation to NSSI in general have been, for the most part, neglected by empirical studies (Fliege et al., 2009). As such, longitudinal studies involving current as opposed to retrospective measures of attachment are important in order to clarify the nature of the association between

attachment and NSSI.

2.4.2 Peers

Adolescence is a transitional period during which young people move away from looking to their parents for social influence and support and instead rely more on their peers (M. L. Cooper et al., 1998; Crone & Dahl, 2012; Wyndol, Buhrmester, Furman, & Buhrmester, 1985). Although child-parent relationships remain more closely related to adolescent NSSI (Fotti, Katz, Afifi, & Cox, 2006; Hallab & Covic, 2010), peer attachment may also be an important factor in young adolescent NSSI through similar pathways as parent attachment (Gandhi et al., 2016), or by normalising the behaviour (O'Connor, Rasmussen, Miles, et al., 2009). Indeed, adolescents who engage in NSSI are more likely to turn to their peers for support than to any other available source, including parents, teachers, and healthcare professionals (E. Evans, Hawton, & Rodham, 2005). The protective effects of positive peer relationships have been demonstrated in a small sample of abused adolescents (Collishaw et al., 2007). Moreover, having one strong source of social support may moderate the impact of dysfunctional relationships in another domain (Hazel, Oppenheimer, Technow, Young, & Hankin, 2014), and the combined effects of dysfunction in both family and peer relationships may be multiplicatively deleterious (Cyr, Clément, & Chamberland, 2014). As such, it is important to continue to investigate the role of peer relationships on adolescent NSSI. There are a number of ways by which interpersonal relationships may influence the onset of NSSI through other more proximal risk factors.

2.4.3 Trauma and attachment - mediation

Another explanation for the link between early adversity and NSSI is that traumatic experiences (particularly those that happen within the home, are perpetrated by a parent figure, or are not adequately responded to by a parent figure) are likely to impair the child's relationship with their parents (Bowlby, 1979; Hughes, 2004). This idea is supported by the fact that familial types of traumatic experiences are most strongly associated with NSSI (Gratz, Conrad, & Roemer, 2002). Adolescents who engage in NSSI are more likely to have experienced familial physical (Mina & Gallop, 1998) and

emotional neglect (van der Kolk, Perry, & Hermann, 1991), traumatic childhood separation from parents (Carroll, Schaffer, Spensley, & Abramowitz, 1980; Gratz et al., 2002), severe family dysfunction (Hallab & Covic, 2010), have come from single parent households, and have a parent with a serious illness or disability (Laye-Gindhu & Schonert-Reichl, 2005), all of which are potentially harmful to the security of their attachment to their parents. Insecure attachment is in turn robustly associated with NSSI, as discussed above. Thus the impairments in attachment security resulting from trauma may mediate the trauma-NSSI association (Figure 2.3)

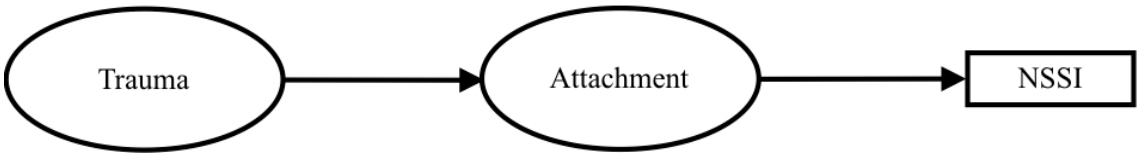


Figure 2.3. Insecure attachment may mediate the association between trauma and NSSI.

2.4.4 Trauma and attachment - moderation

Secure parent-child attachment also appears to act as an important protective factor against the impact of trauma in infant (E. P. Edwards, Das Eiden, & Leonard, 2006), adolescent (Papini & Roggman, 1992), and young adult populations (Aspelmeier, Elliott, & Smith, 2007). Secure child-parent relationships are associated with fewer mental health problems and enhanced social skills and coping strategies (Moretti & Peled, 2004). Thus, secure attachment, and the inherent developmental benefits thereof, may moderate the association between trauma and NSSI (Figure 2.4). Conversely, the adverse corollaries of insecure attachment, such as affective reactivity and poor social support, may make individuals more vulnerable to the impact of trauma (van der Kolk et al., 1991).

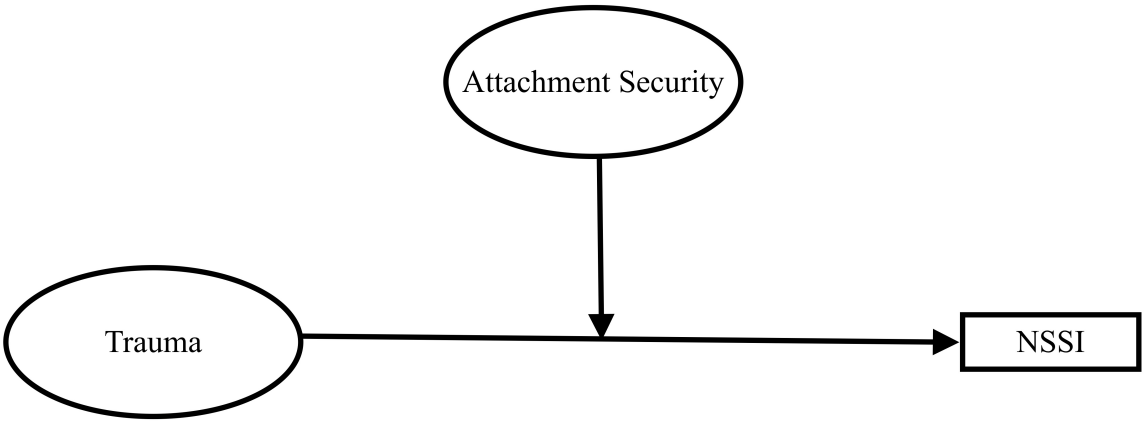


Figure 2.4. Attachment may moderate the association between trauma and NSSI.

2.4.5 Attachment and distress - mediation

As insecurely attached children's distress is repeatedly left unresolved or even aggravated by their attachment figures, development of their own abilities to regulate emotions may be impaired (Linehan, 1993). There is evidence that such impairment is sometimes lasting and potentially irreparable; insecure attachment is associated not only with poorer emotion regulation (Levy et al., 2006; Scott, Levy, & Pincus, 2009), but also with observable differences in the areas of the brain responsible for stress response and emotion regulation (Schore, 2001a, 2001b). Thus insecure attachment is also transdiagnostic risk factor for the development of emotional and behavioural problems (Clarke, Ungerer, Chahoud, Johnson, & Stiefel, 2002) including depression and anxiety (Irons & Gilbert, 2005; Levy, 2005; Manassis, Bradley, Goldberg, Hood, & Price Swinson, 1995; Wei, Vogel, Ku, & Zakalik, 2005), aggression (Lyons-Ruth & Karlen, 1996), anger (Mikulincer & Mario, 1998), and impulsivity (Kobak, Zajac, & Smith, 2009), which are in turn proximal risk factors for NSSI (Figure 2.5). Thus, the psychological distress resulting from insecure attachment may mediate the attachment-NSSI association (Gandhi et al., 2016; Hallab & Covic, 2010; Kelada, Hasking, & Melvin, 2016; Kimball & Diddams, 2007; Tatnell et al., 2014).

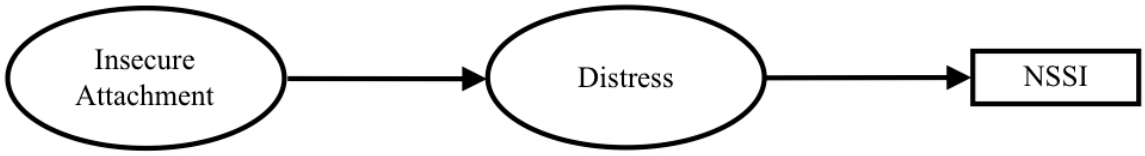


Figure 2.5. Distress may mediate the association between insecure attachment and NSSI.

Insecure attachment may also be associated with NSSI through a specific aspect of psychological distress, low self-esteem. The idea, central to attachment theory, that parents' attentiveness shapes their children's self-concepts (Bowlby, 1979) clearly also implicates attachment in the development and maintenance of self-esteem. This theory is supported by a broad literature demonstrating associations between secure attachment and positive views of the self (Jude Cassidy, 1988; Collins & Read, 1990). These associations are not, moreover, restricted to child-parent attachment alone. While parent attachment appears to be more impactful than peer attachment on wellbeing, both are strongly related to self-esteem (Greenberg, Siegel, & Leitch, 1983).

In turn, low self-esteem is closely linked to both depression (Harter & Susan, 1990; Kaslow, Rehm, & Siegel, 1984; Renouf & Harter, 1990), and NSSI (De Leo & Heller, 2004; Hawton, Kingsbury, Steinhardt, James, & Fagg, 1999). Whether low self-esteem is a direct risk factor for NSSI, or if the association is mediated by depression is unclear, however the impact of attachment on self-esteem may well be one of the ways in which attachment is related to both depression and NSSI. Indeed, multiple researchers have demonstrated the mediating role of self-esteem in the relationship between attachment and depression (Carnelley, Pietromonaco, & Jaffe, 1994; Roberts, Gotlib, & Kassel, 1996; R. B. Wilkinson, 2004). Self-esteem may also be linked to NSSI in another, more direct way. Many young people report engaging in NSSI in order to find out if somebody loves them (Rodham et al., 2004). People who have low self-esteem will be at directly increased risk of engaging in NSSI for this reason.

2.4.6 Attachment & distress - moderation

Attachment may also moderate how adolescents respond behaviourally to distress.

Insecurely attached children with parents that do not respond adequately to their overtures of distress (i.e. crying) may learn to exaggerate their expression of distress in order to secure appropriate responses (Moretti & Peled, 2004). As these children grow into adolescents, they may maintain the same general approach of exaggerated communications of distress but in more age-normative ways, such as acting out, violent outbursts, or engaging in NSSI (Nock & Prinstein, 2004). Thus, attachment may moderate the distress-NSSI association (Figure 2.6). Moreover, as people respond to these outbursts, the adolescent's schema that this is an effective way of gaining comfort, or at least attention, will be further reinforced (Hilt, Nock, Lloyd-Richardson, & Prinstein, 2008).

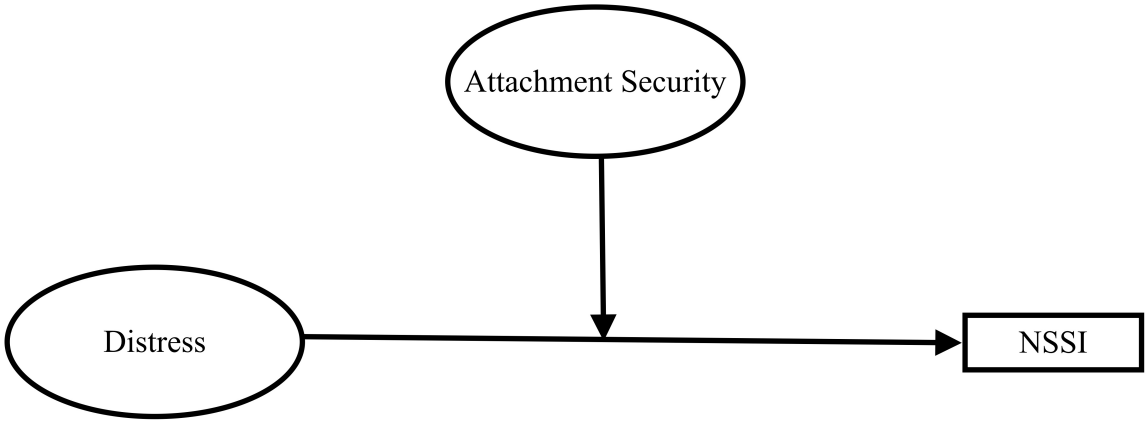


Figure 2.6. Attachment may moderate the association between distress and NSSI.

Whether through social reinforcement or physiological mechanisms, this tendency to exaggerate distress does appear to become deeply ingrained; insecurely attached individuals experience greater distress in response to negative memories (Mikulincer & Orbach, 1995), heightened cortisol responses to distress (Gunnar, Brodersen, Nachmias, Buss, & Rigatuso, 1996; Hertsgaard, Gunnar, Erickson, & Nachmias, 1995), and slower recovery from distress (Kobak et al., 2009). In turn, adolescent engagement in NSSI is directly related to both family conflict and emotion dysregulation (Adrian, Zeman, Erdley, Lisa, & Sim, 2011). Thus, the association between insecure attachment and NSSI appears to be mediated by impaired emotion regulation (Kimball & Diddams, 2007),

while at the same time these regulation impairments may moderate the distress-NSSI association.

Secure attachment may also play an important role as a social resource in times of psychological distress. A key feature of secure attachment is learning to turn to adequately responsive attachment figures, typically parents, for support in times of distress (Moretti & Peled, 2004). Confidence that the attachment figure is an available, reliable, and effective provider of support is central to attachment theory (Bowlby, 2008; H. S. Waters & Waters, 2006). When children's expressions of distress are routinely ignored, dismissed, or punished, they learn that their attachment figures are unreliable and that communications of distress are largely useless (Bosmans et al., 2015; Bosmans, Dujardin, Raes, & Braet, 2013). Insecurely attached individuals may therefore be more ill-equipped to process and respond to distress, because they are unable or unwilling to turn to others for comfort and support (Moretti & Peled, 2004). Young people who engage in NSSI do indeed report less communication with their parents (Claes, De Raedt, Van de Walle, & Bosmans, 2016). In the absence of effective social support from parents, distressed young people with insecure attachment may instead engage in other, more maladaptive methods of regulating distress (Brumariu, 2015), such as NSSI.

Impaired communication of emotions to parents has been repeatedly and robustly linked to adolescent NSSI (Hawton, O 'grady, Osborn, & Cole, 1982; K. E. Miller, King, Shain, & Naylor, 1992; Tulloch, Blizzard, & Pinkus, 1997), and greater communication is associated with positive social adjustment and wellbeing (Segrin, 2005). A study of 6020 adolescents (15 and 16 years old) found that adolescents who engaged in NSSI not only report more difficulty talking to other people about their problems, but also they report fewer people overall with whom they can talk (E. Evans et al., 2005). Moreover, many people who engage in NSSI are alexithymic, showing difficulties in understanding, identifying, and expressing their emotions (Farber, 2008). One of the reasons why adolescents are at increased risk of NSSI may be because they are particularly poor at recognizing and responding to their own feelings and needs, and often therefore express their distress through actions rather than words. Given that the primary reported motivations for NSSI are to relieve and communicate distress (Briere & Gil, 1998), some

adolescents may use NSSI may as an alternative means of communicating distress and eliciting social support when other less pathological methods of communication are unavailable to them (Nock & Prinstein, 2004). Thus, each of insecure attachment and psychological distress may, on their own, be insufficient for a person to engage in NSSI; however when a young person without the social resources and/or communications skills garnered from secure attachment also experiences psychological distress, the interactive effects of these coinciding risk factors may lead them to engage in NSSI.

2.5 Impulsivity and NSSI

Impulsivity is the tendency to act quickly and with little foresight. Self-reported impulsivity has been robustly linked to NSSI in a recent meta-analysis of 27 studies (Hamza et al., 2015). Among high school students, impulsivity was associated with greater frequency, variety of methods, and duration of engagement in NSSI (Dir, Karyadi, & Cyders, 2013). Associations between impulsivity and NSSI frequency (Arens, Gaher, & Simons, 2012; Evren, Cinar, Evren, & Celik, 2012; Peterson & Fischer, 2012; D. Simeon et al., 1992), variety of methods (Claes & Muehlenkamp, 2013; Lynam, Miller, Miller, Bornovalova, & Lejuez, 2011) and severity (Black & Mildred, 2013) have been shown in numerous other studies. NSSI may be a largely impulsive action as it can usually be performed quickly and with little preparation (Nock, 2010).

Impulsivity may influence NSSI proximally by making it more likely that people act on urges to engage in behaviours that have potentially serious and lasting consequences (Lynam et al., 2011), or more distally by leading to increased exposure to adverse experiences (Joiner, 2007). In support of the former idea, a study of 89 adolescent psychiatric inpatients showed that many of them spent less than 5 minutes considering engaging in NSSI before doing so (Nock & Prinstein, 2005). Moreover, impulsivity seems to have a graded relationship with NSSI; clinical inpatients who engaged in repeated NSSI were more impulsive than those who had only done so infrequently, who were in turn more impulsive than inpatients who had never engaged in NSSI (J. Evans, Platts, & Liebenau, 1996).

A number of impulse control related disorders are highly comorbid with NSSI, such as substance abuse (C. Evans & Lacey, 1992) and other risk taking behaviours (Laye-Gindhu & Schonert-Reichl, 2005). In fact, impulsivity seems to account for much of the comorbidity between borderline personality disorder (BPD) and NSSI (Lynam et al., 2011). Some early researchers even proposed that NSSI could be conceptualized as just one symptom or expression of a broader impulsivity disorder (C. Evans & Lacey, 1992), or fundamentally as an impulse control disorder in its own right (Pattison & Kahan, 1983).

The bulk of research on impulsivity and NSSI, however, is cross-sectional, making the direction of the relationship between impulsivity and NSSI difficult to discern (Hamza et al., 2015; Liu et al., 2017). Only four small (n= 55–209) longitudinal studies of impulsivity and NSSI have been conducted, and they provided only weak evidence that greater impulsivity is predictive of NSSI (Black & Mildred, 2013; Chapman, Derbidge, Cooney, Hong, & Linehan, 2009; Glenn & Klonsky, 2011; Peterson & Fischer, 2012). No significant association was observed between impulsivity at time 1 and later NSSI among 209 young adult women (Peterson & Fischer, 2012), among 81 young adult self-injurers (Glenn & Klonsky, 2011), or among 55 female patients with borderline personality disorder (Chapman et al., 2009) when controlling for baseline NSSI. One study of 109 adult women did find a longitudinal link between impulsivity and NSSI (Black & Mildred, 2013), however baseline symptoms were not controlled for, making it impossible to draw conclusions of causality from these results.

Because of this lack of conclusive longitudinal evidence, the directionality of the association between impulsivity and NSSI remains unclear. Therefore, it is possible that greater impulsivity is somehow a result of repeated engagement in NSSI. For example, young people who engage in NSSI may become accustomed to impulsive behaviour by spending time with peers who also engage in NSSI and other impulsive activities (O'Connor, Rasmussen, & Hawton, 2009). Alternatively, the apparent association between impulsivity and NSSI may also be confounded by the complex relationship between impulsivity, distress, and maladaptive coping strategies (Marshall-Berenz, Vujanovic, & MacPherson, 2011). Moreover, repeated engagement in NSSI or chronic

psychological distress associated with NSSI may have neurotoxic effects that impair impulse control (Lupien, McEwen, Gunnar, & Heim, 2009). Finally, young people who engage in NSSI may score themselves more highly on impulsivity questionnaires because they think NSSI must be an impulsive action (Janis & Nock, 2009). Hamza and colleagues (2015) conclude therefore that there is still a need for larger longitudinal studies of impulsivity and NSSI, examining interactions of multiple risk factors, and involving assessments of factors at multiple time points in order to clarify role of impulsivity in the aetiology of NSSI.

Despite the evidence that impulsivity and NSSI are at least contemporaneously correlated, some findings have been contradictory, with researchers finding that only certain aspects of impulsivity are associated with NSSI (Herpertz, Sass, & Favazza, 1997), that impulsivity is associated with the severity but not the presence of NSSI (D. Simeon et al., 1992), that it is only associated with NSSI among females (Hawton et al., 2002), that it is not associated with NSSI at all (J. Taylor, Peterson, & Fischer, 2012), and even that greater impulsivity is associated with less engagement in NSSI (Di Pierro et al., 2012). Further, behavioural laboratory measures of impulsivity have been generally unrelated to engagement in NSSI (Glenn & Klonsky, 2010; Janis & Nock, 2009; Mc Closkey, Look, Chen, Pajoumand, & Berman, 2012), although one meta-analysis detected a moderate overall effect across studies (Liu et al., 2017), and one study found differential impulsivity between participants with and without histories of self-harm in response to emotionally valenced and self-harm related stimuli (K. J. D. Allen & Hooley, 2015).

Glenn and Klonsky (2010) suggest that one explanation for these mixed findings may be the heterogeneity of the construct of impulsivity, the ways in which it is conceptualized, and how it is measured. There is evidence that impulsivity comprises a number of different traits, each associated with different personality domains and neurobiological features (Hamilton et al., 2015; Manuck et al., 1998; Wacker, Chavanon, & Stemmler, 2006; Winstanley, Eagle, & Robbins, 2006). For example, self-report and laboratory measures are only weakly correlated with each other and appear to be measuring different dimensions of impulsivity (Bagge, Littlefield, Rosellini, & Coffey, 2013; Cyders &

Coskunpinar, 2011, 2012; Liu et al., 2017; B. Reynolds, Penfold, & Patak, 2008; Wu et al., 2009). In general, self-report measures are thought to assess cognitive impulsivity, whereas laboratory measures are thought to assess state and motor impulsivity (Cyders & Coskunpinar, 2011; Dougherty, Mathias, Marsh, Moeller, & Swann, 2004; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Thus, behavioural laboratory measures may assess acute, state-sensitive impulsivity, a potential proximal risk factor for NSSI, whereas self-report measures may assess a more stable trait and distal risk factor for NSSI (Liu et al., 2017). This may explain why behavioural and self-report measures appear to be differentially associated with NSSI (Glenn & Klonsky, 2010). In order to address this issue, researchers have developed and validated two multi-dimensional self-report measures for assessing impulsivity, which have both been used in prior studies of NSSI, and which I shall use in this thesis.

2.5.1 The Barratt Impulsivity Scale

The *Barratt Impulsivity Scale* (BIS) (J. Patton & Stanford, 1995) is a widely used and well-validated (M. S. Stanford et al., 2009) self-report measure of three dimensions of impulsivity: 1) motor impulsivity (acting without or before thinking), 2) non-planning impulsivity (failing to consider consequences of actions, particularly in the long term), and 3) attentional impulsivity (making decisions quickly and acting upon them without sufficient consideration). Four studies have used the BIS to explore the relationship between NSSI and impulsivity (Claes & Muehlenkamp, 2013; Evren et al., 2012; Herpertz et al., 1997; Mc Closkey et al., 2012). Hamza and colleagues (2015) performed a meta-analysis of these studies comparing impulsivity among those who engage in NSSI to those who do not. They found that people who engage in NSSI reported significantly greater impulsivity across all three subscales of the BIS. Mean differences and effect sizes across subscales were similar.

2.5.2 The UPPS-P

An investigation of the different dimensions of impulsivity in relation to the big-five personality traits lead to the development and validation of the UPPS Impulsivity scale, a 45-item four-factor self-report measure of inhibitory control, which yields scores for

Negative Urgency (the tendency to act impulsively when feeling negative emotions or distress), Sensation Seeking (the tendency to seek out new and exciting experiences), Premeditation (the tendency to plan ahead before acting), and Perseverance (the ability to remain on task) (Whiteside & Lynam, 2001). A fifth dimension, Positive Urgency, was later validated and added to the scale, producing the 59-item UPPS-P (Cyders et al., 2007).

Since its development, the UPPS has been used in multiple studies to demonstrate the relationship between NSSI and various facets of impulsivity. In one study, participants who engaged in NSSI reported significantly greater urgency, as well as less premeditation and more sensation seeking than the healthy controls (Glenn & Klonsky, 2010). Moreover, within the NSSI group, lower scores on perseverance were predictive of more recent and frequent engagement in NSSI. Many of these findings were subsequently replicated (Lynam et al., 2011). In a non-clinical sample of adolescents NSSI behaviours were significantly related to all five subscales, including both negative and positive urgency (Claes & Muehlenkamp, 2013). Moreover, while Negative Urgency appears to be particularly associated with NSSI across studies (Hamza et al., 2015), Claes and Muehlenkamp (2013) found that different types of NSSI and NSSI from different motivations were related to different aspects of impulsivity, highlighting the importance of using a multidimensional measure of impulsivity.

The associations observed between NSSI and low premeditation are consistent with the idea that people who engage in NSSI are likely to be poorer at planning and therefore do not think through the negative consequences of their NSSI (Hawton et al., 2002), while sensation seeking has been associated with engaging in a number of risky behaviours (Donohew et al., 2000; Wong & Carducci, 1991). Glenn and Klonsky (2010) suggest that the association observed between poor perseverance and higher frequency of NSSI represents people's ability, or lack thereof, to persevere in their resolutions against engaging in self-harm. Finally, associations between NSSI and urgency, both positive and negative, are in keeping with a large literature demonstrating links between NSSI and affective reactivity, or emotional intensity, erraticism, and discomfort.

As the bulk of research demonstrating a link between increased impulsivity and NSSI has been cross-sectional (Hamza et al., 2015), it is difficult to determine how impulsivity is related to other risk factors for NSSI.

2.5.3 Attachment and impulsivity - mediation

In the same way that children learn to regulate their emotions through early interactions with their parents, attachment plays a role in development of impulse control (Londerville & Main, 1981). Insecure attachment among adolescents is associated with higher self-reported impulsivity (Scott et al., 2009), and a number of other NSSI related impulsive behaviours, including sexual risk taking, hostile emotions, and aggressive behaviour (Kobak et al., 2009). As impulsivity has been cross-sectionally associated with NSSI (discussed above), impulsivity may mediate the attachment-NSSI association (Figure 2.7).

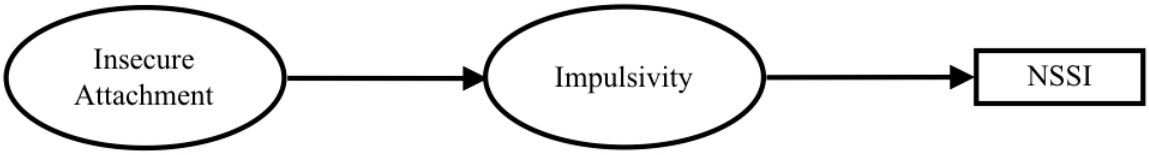


Figure 2.7. Impulsivity may mediate the association between insecure attachment and NSSI.

2.5.4 Impulsivity and distress - moderation

Alternatively, like insecure attachment, impulsivity may be insufficient to cause NSSI alone, but may predispose individuals to engage in NSSI if they are also suffering from psychological distress (Figure 2.8), in keeping with a stress-diathesis model in which the confluence of distress and a predisposition for impulsive actions produces NSSI (Mann, Waternaux, Haas, & Malone, 1999). Indeed, impulsivity in response to strong affect appears to be particularly associated with NSSI (Claes & Muehlenkamp, 2013). Impulsive people may be more likely to act recklessly to alleviate the negative emotions they are experiencing, with little consideration of the long-term consequences of their actions (Cyders & Smith, 2008; Tice, Bratslavsky, & Baumeister, 2001). Since NSSI provides this relief (Klonsky, 2009), and the relief is generally more immediate and

salient than the consequences (Nock & Prinstein, 2005), NSSI is reinforced. Moreover, NSSI may be a particularly accessible coping strategy for impulsive people as it can usually be performed quickly and with little preparation (Nock, 2010).

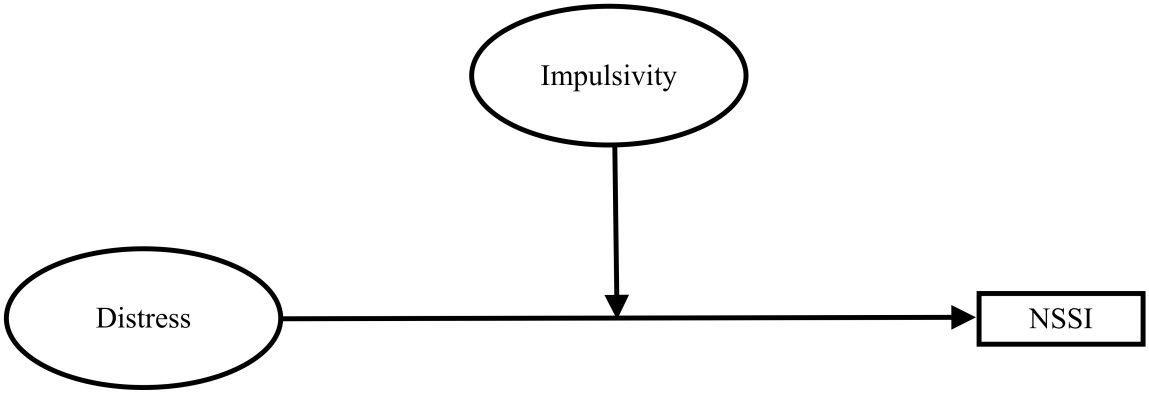


Figure 2.8. Impulsivity may moderate the association between distress and NSSI.

2.5.5 Impulsivity and other risk factors

The association between impulsivity and NSSI remained in some studies that controlled for gender, negative affect, childhood abuse (Arens et al., 2012), eating disorders (Black & Mildred, 2013), depression, anxiety, and alcohol abuse (Glenn & Klonsky, 2010, 2011). However, in other studies, the association disappeared when controlling for depression, childhood trauma, and aggression (Carli et al., 2010), or age, post-traumatic stress disorder, depression, and alcohol abuse (Sacks, Flood, Dennis, Hertzberg, & Beckham, 2008). Likewise, the association between impulsivity and NSSI became non-significant when other risk factors for NSSI were taken into account (Bornovalova, Tull, Gratz, Levy, & Lejuez, 2011; Evren et al., 2012; Rodav, Levy, & Hamdan, 2014). It is possible that impulsivity becoming non-significant in these latter studies may be due to type two errors due to insufficient sample size or multicollinearity; or even mediation (e.g. pathways via post traumatic stress disorder or alcohol abuse). It is nevertheless unclear if impulsivity is itself a significant predictor of NSSI itself, or if it is simply associated with other more meaningful antecedents of NSSI. Finally, impulsivity may influence NSSI by leading to increased exposure to adverse experiences (Joiner, 2007).

Longitudinal models with multiple risk factors are needed to clarify the relationship between impulsivity and NSSI.

2.6 Future directions

A recent review on NSSI research advised, "future research should include (a) longitudinal studies; (b) a psychometrically sound assessment of deliberate self-harm; (c) proximal stress factors (life events, stress, daily hassles, or situational triggers) that occur prior to the onset of deliberate self-harm; (d) the coping with stress dimension; (e) the potential role of social resources; (f) models that test interactions or transactional relations between risk factors, including mediating and moderating effects, as well as interactions between dynamic risk factors and target behaviour, including unidirectional and bidirectional effects; and finally (g) models that test moderating effects of protective factors" (Fliege et al., 2009). It is my intention to meet all of these goals in the present dissertation by:

a) Conducting longitudinal studies able to identify prospective risk factors for NSSI;
b) Using psychometrically valid measures of NSSI;
c) Assessing proximal risk factors such as current distress and family functioning;
d) Assessing potential protective factors that moderate the impact of trauma and distress;
e) Examining social factors (both family and peer) as both mediators and moderators of the associations between other risk factors and NSSI;
f) Exploring multiplicative interactional effects between risk factors, such as impulsivity and distress, or distress and insecure attachment, in producing NSSI;
g) Examining the moderating effects of secure attachment on the well-demonstrated distress-NSSI and trauma-NSSI associations.

2.7 Data sources

In order meet the goals set out by Fliege and colleagues for future work in this area, I have drawn on data from several large datasets with diverse samples of adolescents and young adults. One of these was a study I conducted myself: the Self-Harm and Relationship Experiences (SHARE) study. I also analysed data from three other datasets in collaboration with the study leaders: Roots (Lewis, Jones, & Goodyer, 2015), NSPN (Kiddle et al., 2017), and JOnG! (Baetens et al., 2014). While these latter three datasets comprised a large number of instruments and measures, only the instruments and measures used in the analyses presented within this dissertation will be described herein. All instruments used in SHARE will be described as SHARE was designed specifically for the purposes of this dissertation. Further details of these datasets, samples, procedures, and measures are reviewed in the appropriate chapters of the thesis.

2.8 Conclusion

Psychological distress, child-parent and child-peer relationships, impulsivity, and childhood trauma have all been robustly associated with adolescent NSSI, however these factors are all also closely related to each other. Thus the casual and temporal relationships between these risk factors and the ways they interact with each other to produce NSSI remain unclear. Multidimensional longitudinal models of risk factors for NSSI are therefore necessary in order to better our understand the aetiology of this dangerous behaviour, in particular the interplay between these risk factors. In this thesis I will present analyses of several large longitudinal data sets, conducted with the aim of clarifying these pathways from risk to NSSI.

Chapter 3

Pathways from trauma to NSSI

While childhood family adversities (CFA) are particularly associated with the emergence of adolescent NSSI (Gratz et al., 2002), the causal pathways and mechanisms for the well-established relationship between this distal risk factor and subsequent NSSI up to two decades later are, however, unclear. Two recent reviews concluded that although CFA was a robust predictor of NSSI, the roles of other factors, such as family functioning and mental illness, should be investigated as potential moderators or mediators of the CFA-NSSI association (Fliege et al., 2009; Maniglio, 2011). Both reviews also emphasised the need for longitudinal analyses in order to clarify causal relationships between correlated risk factors for NSSI. In this chapter I will test four possible models for the CFA-NSSI association, supported by the literature reviewed in Chapter 3.

Abstract

Background: Exposure to childhood family adversity (CFA) is associated with subsequent emergence of NSSI during adolescence. However, the pathways through which this early environmental risk may operate are not clear.

Aims: I tested four alternative hypotheses to explain the association between CFA and adolescent-onset NSSI.

Methods: A community sample (Roots) of n = 933 fourteen year olds with no history of NSSI were followed for three years.

Results: Poor family functioning at age 14 mediated the association between CFA before age 5 and subsequent onset of NSSI between 14-17 years.

Conclusion: The findings support the cumulative suboptimal environmental hazards (proximal family relationships as a mediator) hypothesis. Improving the family environment at age 14 may mitigate the effects of CFA on adolescent onset of NSSI.

3.1 Pathways from trauma to NSSI

In this chapter I will test the following four hypothesized pathways through which childhood family adversity (CFA) might affect adolescent NSSI.

i. Mental illness model

CFA is robustly associated with subsequent mental illness (Dunn et al., 2011; Fergusson et al., 2008; van Harmelen et al., 2016). Mental illness is in turn a risk factor for NSSI (Dunn et al., 2011; Nock & Kessler, 2006). Thus NSSI may not be a direct response or consequence of CFA but arise from subsequent mental illness.

ii.) Suboptimal environmental hazards model

CFA often occurs within a context of more pervasive, chronic sub-optimal family environments (Dunn et al., 2011). This continued and more proximal family dysfunction may increase the risk for adolescent NSSI (Gratz et al., 2002) as opposed to the earlier experiences of CFA.

iii.) *Proximal environmental mitigation model*

Positive family and/or peer relationships in adolescence may reduce the CFA-NSSI association (Aspelmeier et al., 2007; Collishaw et al., 2007), either because the adolescent would have found social supports from their positive family and/or peer interactions, or because the family members who previously contributed to CFA are now more positive supports.

iv.) *Attachment model*

Conversely, attachment theory would suggest that CFA is a necessary and sufficient cause for later psychopathology including NSSI as early experiences inform an immutable internal working model of the world (Bowlby, 1988b). This hypothesis predicts that schemas formed in the context of CFA would lead to appraising the world as hostile in adolescence and later life. As there would be no updating of the internal model, these schemas would persist regardless of more proximal experiences such as improved

family functioning in adolescence. Thus there would be a main effect between CFA and the emergence of adolescent NSSI, and no interaction with more proximal factors.

I tested these four hypothesized models of the intermediate pathway between early life (i.e. pre-age five) CFA and adolescent (between ages 14-17) onset of NSSI:

a) Mental illness model: mental illness before the age of 14 as a mediator
b) Suboptimal environmental hazards model: proximal family relationships as a mediator
c) Proximal environmental mitigation model: proximal family and/or peer relationships as a moderator
d) Attachment model: a direct relationship, that is neither mediated nor moderated by proximal family relationships

3.2 Methods

3.2.1 Participants and procedures

Data for the current study were collected as part of Roots, a larger longitudinal study of risk factors for the development of psychopathology. Roots is a community sample of adolescents recruited from a wide geographical area extending 30 miles north, 20 miles south and 20 miles west of Cambridge UK (Ian M. Goodyer, Croudace, Dunn, Herbert, & Jones, 2010; Lewis et al., 2015). All recruitment and data collection was completed by researchers other than myself. In total, 27 secondary schools (25 state and 2 private schools) were approached for participation, of which 18 agreed. Through these schools 3762 students were invited to participate. Overall, consent forms were received from 1238 (33%) students; 675 girls (54.5%) and 563 (45.5%) boys. Although the sample covers a wide socioeconomic range as measured by ACORN (see below), the sample is disproportionately affluent, comprising roughly twice as many ‘wealthy achievers’ and only half as many participants of ‘moderate means’ or ‘hard-pressed’ families compared to UK figures. The study was approved by Cambridgeshire 2 research ethics committee,

reference number 03/302. Data were collected when the adolescents were 14 years old, 15.5 years and 17 years.

Since the primary outcome variable is new onset of NSSI by age 17, all analyses were performed on subsample of 933 participants who reported no lifetime NSSI by age 14 and provided follow up data on NSSI at age 17. Thus, all instances of NSSI reported at age 17 were new incidences between ages 14 and 17 and all observed associations between other variables and NSSI are prospective.

3.2.2 Measures

NSSI: the *Drug, alcohol and self-injury questionnaire* (DASI) was developed as a self-report measure of cigarette, alcohol and drug use and NSSI. My primary outcome variable was a binary question: 'Have you ever tried to hurt yourself on purpose without trying to kill yourself?' This question was applied at the 14 and 17 year assessments. The reliability and validity of this question have been demonstrated through finding similar population prevalence of NSSI in two separate community studies (P. O. Wilkinson et al., 2017), and moderate convergent validity (r = .66) with another well-validated multi-item measure of self-harm behavior, the Self-Harm Inventory (Sansone, Wiederman, & Sansone, 1998) in the SHARE sample.

Trauma: the *Cambridge Early Experience Interview* (CAMEEI) (Dunn et al., 2011; St Clair et al., 2015) was used to measure childhood family adversity (CFA). The CAMEEI is a semi-structured interview conducted with the adolescent's primary caregiver. The interview comprises questions about several components of CFA, including abuse, family discord, family loss, parental mental illness and parenting style over three distinct age epochs (pre-primary school; primary school; secondary school).

In a prior analysis, factor analysis did not suggest a unidimensional structure of exposure to these adversities, and model fit was poor for the two factor model (Dunn et al., 2011; St Clair et al., 2015). A mixture model perspective was therefore used, which grouped individuals by their experience of multiple adversities using latent class analysis (LCA). LCA identified four patterns of early family environment in the participants before the

age of 5: Optimal class, with low levels of adversity (69%); Discordant class, with moderate levels of adversity (19%); Hazardous class, with high levels of adversity (6%); Atypical parenting class, with low levels of adversity but high levels of sub-optimal parenting and moderate levels of low maternal warmth (7%). These latent classes are orthogonal rather than ordinal. To enable the proposed analysis to have adequate power, and to be consistent with other analysis from Roots, participants were dichotomized. As the latter three classes all reflect sub-optimal early family environment, participants from these three classes were combined into a CFA present group, while those from the optimal class were classified as no CFA.

Diagnosis: *The Kiddie-SADS-Present and Lifetime Version* (K-SADS-PL) (Kaufman et al., 1997) was used to assess whether participants met DSM-IV criteria for the diagnosis of a mental disorder. The K-SADS-PL is a semi-structured interview about participants' current and previous experiences of psychopathology. The participant and a caregiver were interviewed separately when the participant was age 14. A clinical diagnosis was then assigned by a consultant psychiatrist. In two longitudinal studies, adolescents with 'High Clinical Index (HCI)' case status (one symptom less than threshold, in conjunction with significant impairment) showed similar psychopathology trajectories to those meeting full diagnosis of major depression (Fergusson et al., 2005; Johnson, Cohen, & Kasen, 2009). Therefore, consistent with other analyses from Roots, participants were dichotomized based on presence or absence of a diagnosis/HCI of any mental disorder (depression, anxiety disorders, eating disorders, substance use disorders, and disruptive behavior disorders) at or before age 14.

Family functioning: the *McMaster Family Assessment Device General Functioning Subscale* (FAD-GF) (Epstein, Baldwin, & Bishop, 1983) was used to evaluate current general family functioning. The FAD-GF comprises 12 self-report questions about the overall current quality of family relationships. Higher FAD-GF scores are associated with better family functioning. The FAD-GF is widely used and its psychometric reliability and validity have been demonstrated in a number of samples (Georgiades, Boyle, Jenkins, Sanford, & Lipman, 2008; Kabacoff, Miller, Bishop, Epstein, & Keitner, 1990; I. W. Miller, Epstein, Bishop, & Keitner, 1985; Shek, 2002).

Socioeconomic status: *A Classification of Residential Neighbourhood (ACORN)* (CACI Information Services, 1997) was used as a measure of socioeconomic status (SES). Five levels of SES (Wealthy Achiever, Urban Prosperity, Comfortably off, Moderate means, Hard-pressed) were derived from postcodes (www.caci.co.uk). In the present study the sample was dichotomized as belonging to moderate means/hard pressed (low SES) versus any of the more affluent categories.

Friendships: The *Cambridge Friendship Questionnaire* (CFQ) (I. M. Goodyer, Wright, & Altham, 1989) was used to measure the quality of children's relationships with their peers. The CFQ is an 8 item self-report instrument that assesses the number, availability, and quality of friendships. The CFQ was developed from a semi-structured interview based on ethological principles of social relationships and the developmental significance of friendships (Pellegrini & Bartini, 2000). The CFQ has demonstrated ecological validity across two samples (van Harmelen et al., 2016, 2017). The CFA yields a single total score with higher scores indicating more positive perceptions of peer relationships (i.e. 'Friendships').

3.2.3 Analysis procedure

I set out to investigate the relationship between CFA (<5 years) and adolescent onset of NSSI (between age 14-17) through two separate mediator pathways (i.e. family relationships at age 14 and mental illness up to age 14) shown in Figure 3.1. I also tested whether family and peer relationships moderated the effects of CFA, using CFA x family/peer relationships interaction terms. I used the user-written binary logistic mediation package (Ender, 2011) for STATA. Robust confidence intervals for direct and indirect effects were estimated using 5000 bootstrap repetitions. The binary mediation package does not provide p values.

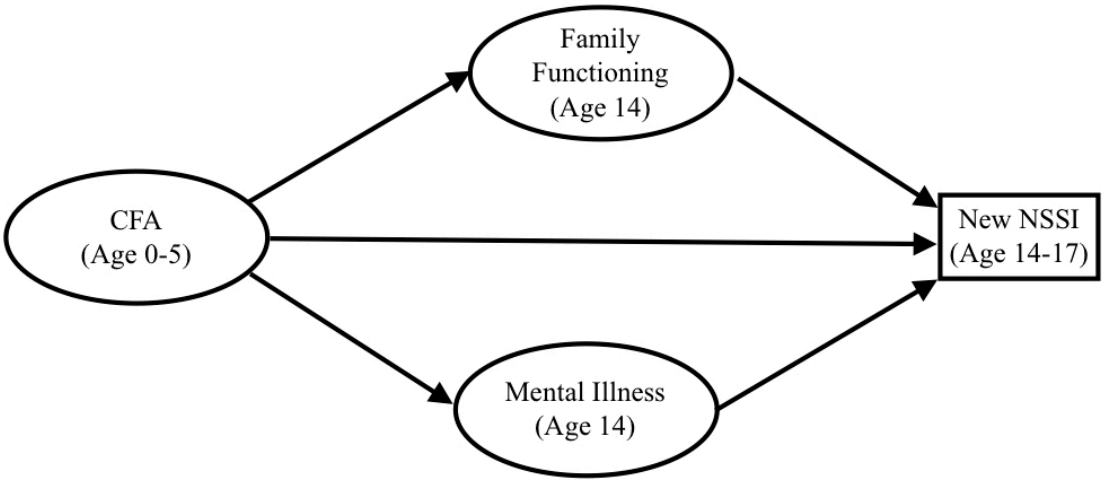


Figure 3.1. Path diagram of the proposed model of potential pathways from childhood family adversity (CFA) to new NSSI by age 17, both directly and through family dysfunction at age 14 and diagnosis of mental illness before age 14.

Prior to running a multiple mediation model, I examined the correlations between NSSI by age 17 and potential predictor variables, including family and peer relationships at age 14 and mental illness pre-14. To aid interpretation and comparisons, r statistics were calculated: point-biserial correlations for dichotomous-continuous associations, and tetrachoric correlations for dichotomous-dichotomous associations.

As there were significant predictors of missingness in baseline data, data cannot be presumed to be missing at random, potentially biasing estimates (Sterne et al., 2009). In the subsample of participants without lifetime NSSI at age 14 (the key inclusion criterion), there was minimal missing data on NSSI at age 17 (12%, see results for more details). However, with the inclusion of baseline model variables, missingness in follow up data increased to 26% (n = 781), reducing the number of new NSSI cases from 59 to 47 and increasing the chance of selection bias. Therefore I performed multiple imputation of baseline model variables using chained equations, producing 17 imputations (the variable with greatest missingness, family functioning, was missing for 17% of the sample). Sixteen significant predictors of the primary variables (pre age 14 mental illness, age 14 family functioning, pre age 5 CFA, and new onset NSSI by age 17), and missingness on these variables were included in the imputation model. Analyses

were performed on imputed data based on complete data for NSSI at age 17 and no reported lifetime engagement in NSSI by age 14.

Analyses were conducted using STATA, version 14 (StataCorp, 2015).

3.3 Results

3.3.1 Univariate associations with NSSI and CFA

At age 14, 1202 participants reported on NSSI, of which 1059 (88%) reported no history of NSSI. Of this latter group, 933 (88%) participants reported on NSSI up to age 17. A total of 59/933 (6%) participants reported new onset of NSSI by age 17. Comparison statistics between participants with and without age 17 NSSI data are shown in Table 3.1. Participants without follow-up NSSI data at age 17 had poorer family functioning, greater CFA, a higher likelihood of having a diagnosis, and were from lower SES than participants that provided follow-up NSSI data. All of these factors were accounted for in conducting multiple imputation.

Table 3.1
Descriptive and comparison statistics of baseline (age 14) data between participants with and without all follow-up NSSI data

	Sample with age 17 NSSI data		**Sample without age 17 NSSI data**		**Comparison statistics**		
	mean	SD	mean	SD	*smd*	t	*p*
Family functioning	22.70	5.58	21.60	5.80	-0.20	-2.09	0.037
Friendships	26.04	4.10	25.43	4.44	-0.15	-1.90	0.058
	% Yes		% Yes		% diff	Chi^2	*p*
CFA	27.97		38.81		10.84	9.52	0.002
Diagnosis	14.31		17.41		3.10	4.05	0.044
Male	46.74		48.91		2.17	1.54	0.214
Low SES	11.75		20.07		8.32	13.09	0.001

smd: standardized mean difference

Table 3.2 demonstrates univariate associations between predictor variables and new onset of NSSI between the ages of 14 and 17. Poorer family functioning at age 14, mental illness by 14, and CFA were positively associated with new onset of NSSI between ages 14 and 17. Friendships and SES were not associated with NSSI. Gender was also not associated with new onset of NSSI from ages 14-17 (male new incidence=0.05%, female new incidence=0.07%, $\chi 2=1.06$, p=0.35).

Table 3.2 also shows correlations between predictor variables and CFA. Poorer family functioning at age 14 and diagnosis of a mental illness before age 14 were positively correlated with CFA and new NSSI. Therefore family functioning and mental illness are potential mediators for the CFA-NSSI association. Family functioning and mental illness were reasonably uncorrelated with each other (r = -0.12) and had low variance inflation factors (mean variance inflation factor = 1.01), suggesting that multicollinearity was not an issue.

Table 3.2
Correlations between new NSSI from ages 14-17, CFA, and potential mediator and explanatory variables measured at the age of 14

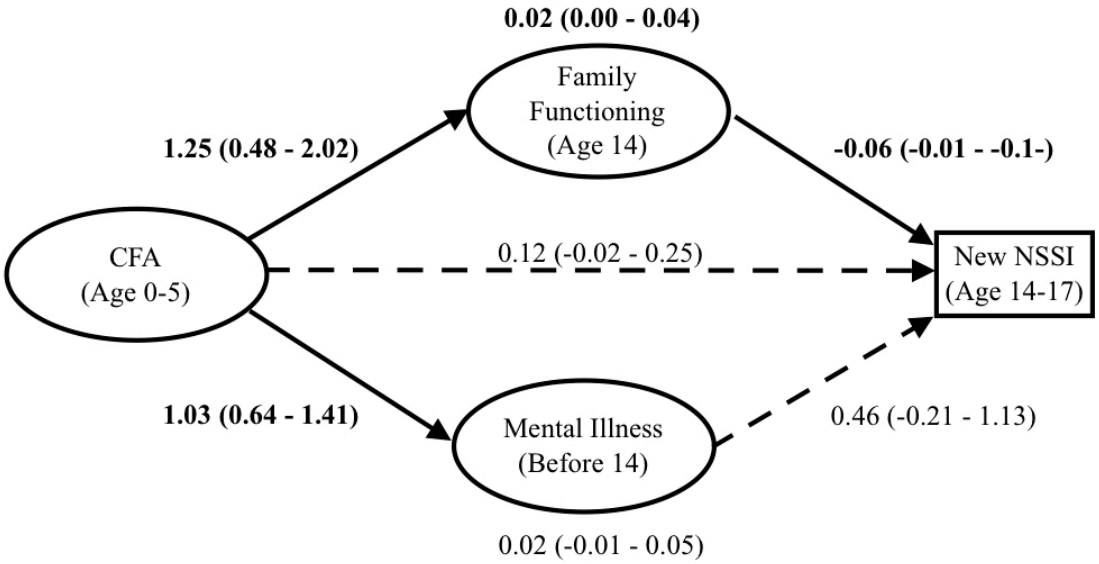
	New Onset of NSSI		**CFA**	
	r	***p***	**r**	***p***
CFA	0.08	0.020		
Gender	0.03	0.303	-0.05	0.100
Diagnosis	0.07	0.037	0.18	< 0.001
SES	-0.01	0.729	0.17	< 0.001
Family functioning	-0.09	0.007	-0.10	0.001
Friendships	-0.05	0.173	-0.06	0.071

r statistics represent tetrachoric correlations for CFA, gender, DSM diagnosis, and SES, and point-biserial correlations for family functioning and friendships.

3.3.2 Revealing a psychosocial model for 1st episode NSSI

Results of the binary logistic multiple mediation analysis are shown in Figure 3.2. Family functioning significantly mediated the association between CFA and NSSI. The direct pathway between CFA and NSSI was non-significant as was the indirect pathway through mental illness before age 14. This model accounted for 16% of the variance in

new onset of NSSI between aged 14 and 17. Friendships and family functioning did not significantly moderate the effects of CFA or mental illness on NSSI, nor did friendships moderate the effects of family functioning on NSSI (all $p > 0.08$).



The model displays standardized coefficients (95% confidence intervals) of the direct effects of CFA and mediators on NSSI; and the indirect effects of CFA on NSSI through each of the mediators (at the top and bottom of the figure). Significant effects ($p < 0.05$) are shown in bold with solid lines.

Figure 3.2. Path diagram of the multiple mediation model of the effect of CFA on new onset of NSSI through mental diagnosis and family functioning.

Findings with complete case analyses resembled those with imputed data, however in this smaller sample of 783 participants with complete data, the indirect pathway from CFA to NSSI through mental illness was also significant (estimate = -0.02, CI = -0.05 – 0.00). As with the imputed data, in full case analyses the indirect path from CFA to NSSI path through adolescent family functioning was also significant (estimate = -0.04, CI = -0.01 – 0.09). Further details of complete case analyses can be found in Appendix A.

3.4 Discussion

In this chapter I tested four hypothesized models of the association between childhood family adversity (CFA) and the onset of non-suicidal self-injury (NSSI) between the ages of 14 and 17. I found evidence to support the chronic suboptimal environmental hazards hypothesis: family functioning at age 14 mediates the association between CFA before the age of 5 and onset of NSSI between ages 14 and 17. Traumatic experiences often happen in the context of continuing family dysfunction, and this impaired family functioning later in adolescence is in turn robustly associated with NSSI (Gratz et al., 2002). Family functioning may influence adolescent NSSI through several risk factors for NSSI such as impulsivity, emotion regulation (Scott et al., 2009), self-esteem (Collins & Read, 1990), interpersonal skills (Hazel et al., 2014), coping skills, and mental illness (Moretti & Peled, 2004). These pathways warrant further investigation. The present findings, however, suggest that improving family relationships may reduce the later onset of NSSI in children who have been exposed to CFA.

The indirect pathway from CFA to NSSI through mental illness was not significant. It is worth noting that in complete case analyses this pathway was significant along with the pathway through family functioning, giving possible support to the mental illness model. Therefore it is possible that treating mental illness may mitigate some of the effects of CFA on adolescent NSSI. The non-significant finding in the imputed cases analysis may be a type 2 error; alternatively the significant finding in the completed cases analysis may be due to attrition bias, corrected by the imputation. Further analysis in larger datasets is warranted to answer this important question.

I found no support for the proximal environmental mitigation model: positive proximal peer and family relationships do not reduce the effects of early life CFA, distress, or poor peer / family relationships on the incident risk rate of NSSI between 14 and 17 years. Indeed, peer relationships did not affect risk of NSSI, in keeping with the literature (Hallab & Covic, 2010). With regard to family relationships, whether or not family adversity continues seems to be the primary factor that influences risk of NSSI, rather than support from positive family members reducing harm from earlier adversity.

Furthermore, I found no support for the attachment model: there was no significant direct association between CFA and adolescent-onset NSSI, when mediating effects of proximal family adversity and mental illness were controlled for. This suggests that the effects of CFA on NSSI are modifiable and perhaps that internal working models of threat can be updated by subsequent experience.

3.4.1 Clinical implications

Findings from this study are consistent with a large amount of pre-existing literature demonstrating that CFA has long-term psychopathological consequences (Perry, Pollard, Blaicley, Baker, & Vigilante, 1995) including being a risk factor for adolescent NSSI (Maniglio, 2011). Reducing CFA, therefore, is likely to reduce NSSI. However, the present findings also suggest improving family function after CFA may reduce later NSSI. It is important, therefore, that services that help families in trouble, such as social care, try to address family relationships directly. Further research is needed to investigate potential methods of improving family relationships after CFA. Future studies should then examine whether these improvements reduce later NSSI.

3.4.2 Limitations

One weakness of this study is that I did not distinguish between different methods, motivations or frequencies of NSSI. This is potentially problematic as different methods and frequencies of NSSI have been related to different psychological and environmental factors (Rodham et al., 2004). However, with a sample size of less than 1000, I would not have had sufficient power for mediation/moderation analyses if I had split the primary outcome variable. A further weakness of this study was that CFA before the age of 5 was assessed retrospectively at the age of 14, which may have reduced accuracy (Ebner-Priemer et al., 2006).

Another limitation of this study is that the sampling age range may have been too late to capture many first incidents of NSSI. The natural course of NSSI is curvilinear, with a sharp increase around age 12 and a decrease in later adolescence (Plener, Schumacher, Munz, & Groschwitz, 2015). Longitudinal studies beginning at a younger age (before 12)

would be greatly beneficial as they would capture more first incidents of NSSI and therefore have greater statistical power for detecting prospective risk factors.

3.5 Conclusion

The findings of this study support the conclusion that family functioning at age 14 mediates the relationship between CFA before age 5 and new onset of NSSI between ages 14-17. The pathway from CFA to subsequent NSSI through early adolescent family functioning is mediational rather than moderational: CFA increases the risk of poor family functioning, which in turn increases the risk of NSSI. Therefore if the link between CFA and family functioning at 14 is broken, then the risk of later NSSI should be reduced. The intermediary role of contingent psychological distress on the association between CFA and NSSI warrants further investigation. Interventions to improve family functioning and prevent/treat psychiatric illness may reduce future incidence in children exposed to CFA.

Chapter 4

Positive Parenting and NSSI: Factor structure and validation of the Positive Parenting Questionnaire

In the last chapter I demonstrated that impaired family functioning mediated the association between childhood family adversity and NSSI. However, the pathways through which child-parent relationships during adolescence influence NSSI, and the role of psychological distress, remain unclear. While some studies have demonstrated the protective effects of positive child-parent relationships (Aspelmeier, Elliott, & Smith, 2007; Papini, & Roggman, 1992), and others showed some of the benefits associated with them (Cassidy, 1988; Collins, & Read, 1990; Moretti, & Peled, 2004), most of the existing literature focuses largely on dysfunctional family relationships or insecure child-parent attachment. The benefits and impact of positive child-parent relationships, on adolescent NSSI and in general, may have been largely overlooked in part due to the fact that few if any well-validated measures of positive child-parent relationships exist. In order to investigate the role of positive parenting on adolescent NSSI, I have analysed data from the Neuroscience in Psychiatry Network (NSPN) project. In this chapter I present the validation of a new and much needed measure of children's perceptions of positive parenting, the Positive Parenting Questionnaire (PPQ). In the next chapters I will present a series of path analyses using this new measure to clarify the specific ways in which child-parent relationships are associated with adolescent NSSI. Before presenting the validation of the PPQ, I shall review existing measures of child-parent relationships and highlight their disproportionate focus on dysfunction.

Abstract

Background: Positive parenting may be an important influence on child and adolescent development, adjustment, and wellbeing, yet few well-validated measures of positive parenting exist. The current study aimed to redress this gap by producing and validating a measure of adolescents' perceptions of positive qualities of their relationship with their parents, the Positive Parenting Questionnaire (PPQ).

Methods: The PPQ is a self-report questionnaire comprising 26 statements about a wide range of aspects of positive parenting as perceived by the participant. A community-recruited sample of 2,432 adolescents (age in years: M=19, SD=3, range=14-25; 54% girls) completed the PPQ, as well as two other existing measures of child-parent relationships (the short form Alabama Parenting Questionnaire and the Measure of Parenting Style questionnaire), a measure of peer relationships (The Cambridge Friendship Questionnaire), an Index of Multiple Deprivation based on postcodes, items on previous histories of non-suicidal self-injury (NSSI) and parental education, and a multi-instrument measure of psychological distress. Participants who completed the first questionnaire package were sent another questionnaire package comprising the same instruments one year later.

Results: The PPQ can be calculated as either a single-scale total score, or as three sub-scales: Support, Motivation, and Generosity. The PPQ total and subscales showed good internal reliability, stability across time points, and convergent validity with the other measures of parenting. Although a three factor solution was suggested by factor analyses, the sub-scales were highly inter-correlated. The total score had the highest Cronbach's alpha of any of the PPQ scales and showed equivalent if not superior predictive validity to any of the other PPQ scores or other measure of child-parent relationships.

Conclusion: The PPQ is a psychometrically sound, reliable, and valid measure of positive parenting. Unless there is an a priori theoretical reason why motivation and generosity would be particularly relevant to the research question under investigation, the total sum may be both the most parsimonious and informative score that can be derived from the PPQ.

4.1 A review of existing measures of child-parent relationships

For decades, researchers have recognized the importance of developing valid and reliable measures of the quality of young people's relationships with their parents (DeCato, Donohue, Azrin, Teichner, & Crum, 2002). Despite the wide range of social and developmental outcomes (Sroufe et al., 1999) associated with positive child-parent relationships, few well-validated measures assess positive parenting across multiple domains. Two reviews of child-parent relationship measures highlight this deficit.

DeCato and colleagues reviewed 20 youth self-report measures that at least in part assessed child-parent relationship quality (DeCato et al., 2002). Of the five instruments specifically designed to measure adolescents' satisfaction with their parents, three were developed and validated before 1965 and for this reason alone may be inappropriate for use with present day adolescents, for whom life, relationships, and even vocabulary differ immensely from those of the 50's and 60's. The fourth measure they reviewed was the Parental Control Measure (Prinz, Foster, Kent, & O'Leary, 1979), which is specifically a measure of parental control and discipline and does not provide insight into other domains of the parent-child relationship. The fifth measure, the Youth Happiness with Parent Scale (see 1), comprises 11 items, each pertaining to a different aspect of the parent-child relationship (e.g. Communication, Friends and Activities, Household Rules, Chores, Substance Use etc.). However, this measure has only been evaluated and used with a predominantly male clinical sample with behavioral and substance abuse disorders, and as such its validity with normative populations is unclear. Moreover, as each different domain of child-parent relationships is broadly assessed by a single item, the sub-scales of this instrument may lack accuracy.

DeCato and colleagues also reviewed a number of measures of both parent and adolescent satisfaction with their mutual relationships, of which several partially assessed positive aspects of these relationships. Of the 20 measures reviewed, none assessed primarily positive aspects of the adolescent's relationship with their parent whilst also reporting adequate psychometric properties. One measure, the Family Life Questionnaire (Guerney Jr., 1977), comprises three 20-item forms pertaining to satisfaction and

harmony in the parents' marital relationship, the father-son relationship, and the mother-daughter relationship, respectively. This specific format however neglects father-daughter and mother-son relationships, meaning this instrument cannot be applied to children without a same-gender parent, such as in half of families with a single parent or same sex parents. This is particularity problematic given that children are increasingly growing up in non-traditional families (Teachman, Tedrow, & Crowder, 2000) and it would generally be a mistake to exclude them from research. Moreover, the scale contains many negative items, such as "Most of the time one of us is arguing with the other," as well as vague items such as "We should be more like another father/son or mother/daughter I know."

The Parent–Child Happiness Scale (Frederiksen, Jenkins, & Carr, 1976) comprises items pertaining to the parent or adolescents' satisfaction with behavioral aspects of their relationship, and one pertaining to their happiness with the relationship in general, however the method of the scales development, and the descriptive and psychometric properties of the scale are all unreported.

In all, of the 20 instruments reviewed, only the Parent–Child Areas of Change Questionnaire (Jacob & Seilhamer, 1985) assessed adolescents' satisfaction with their relationship with their parent across multiple domains, and demonstrated acceptable psychometric properties. This measure, however, focused largely on rules and discipline, neglecting more interpersonal aspects of the relationship. Moreover, like other instruments such as the Mutual Dissatisfaction Inventory (Tarter et al., 1993), it focused primarily on negative aspects of the relationship and areas where conflict occurs.

In a more recent review, Alderfer and colleagues examined 29 family assessment measures, including 7 self-report measures of general family functioning and three self-report measures of parent–child relationships (Alderfer et al., 2008). None of the ten self-report measures of general family functioning and parent–child relationships reviewed were focused on positive child-parent relationships whilst also meeting the authors' criteria for being well established: the measure must have been presented in at least two independent peer-reviewed articles; sufficient statistical information must have been provided to allow evaluation and replication; and details of good reliability and validity

must have been presented in at least one peer-reviewed article. Whilst the Family Assessment Device (Epstein et al., 1983), the Family Assessment Measure-III (Skinner, Steinhauer, & Sitarenios, 2000), the Family Relationship Index of the Family Environment Scale (Holahan & Moos, 1982), the Revised Children's Report of Parental Behavior Inventory (Schludermann & Schludermann, 1988), the Issues Checklist (Robin & Foster, 2003), and the Inventory of Parent and Peer Attachment (IPPA) (Armsden & Greenberg, 1987), all met these criteria for being well-established, all of these instruments either contain numerous negative items, or, as with the Issues Checklist, are predominantly negative, measuring the presence or absence of family dysfunction rather than positive aspects of parent-child relationships.

The IPPA perhaps comes closest to measuring predominantly positive aspects of parent-child relationships or attachment, providing three subscale scores of trust, communication, and alienation, however it still contains numerous negative items such as "I wish I had different parents," and "I don't know whom I can depend on these days". In addition, the IPPA is almost completely focused on psychological perceptions of the child-parent relationships, neglecting more behavioral aspects of parenting such as provision of resources and care, and engagement.

While the well-validated measures reviewed above do indeed provide valuable insight into the quality of adolescents' relationships with their parents, there seemed to be an over-emphasis on family dysfunction. Since these reviews were conducted, no new measures of positive aspects of child-parent relationships have been published with psychometric validation, so far as I can find. I aimed to redress this gap by validating a measure of adolescents' perceptions of positive qualities of their relationship with their parents, the Positive Parenting Questionnaire (PPQ).

4.2 Development of a new measure

In their review, Alderfer and colleagues advise that important areas to be assessed in measures of child-parent relationship satisfaction are: family organization, cohesion,

communication, affective environment, and problem solving ability. The PPQ, while focusing on positive aspects of the child-parent relationship, comprises items pertaining to all of the above areas and in doing so aims to provide an accurate and well-rounded indication of child-parent relationship satisfaction. Also fundamental to child-parent relationships is the concept of attachment, which centres on children's perceptions of their parents' accessibility and responsiveness to their needs, demands, and communications (Ainsworth, 1989; Bowlby, 1988a). The PPQ includes items related to these important attachment-related aspects of child-parent relationships as well. Alderfer and colleagues add, however, that general measures of satisfaction can be derived from these subcategories, which may be how the PPQ functions.

In their review, DeCato and colleagues advise, "Future research should continue to develop reliable and valid measures to assess parents' and youths' satisfaction with behaviors in socially important areas. Future research should also employ large, randomly selected, stratified nonclinical samples to provide norms for… parent–adolescent satisfaction measures." Further, Alderfer and colleagues conclude their review by recommending that developers of family relationship measures "attend closely to the psychometric properties of their measures, submit their work for evaluation by their peers, and strive to publish in empirical venues". It is my hope that the PPQ will satisfy all of these recommendations and, moreover, meet Alderfer and colleagues' criteria for good psychometric properties: internal consistency above .70 (Nunnally, 1978); test–retest reliability indicated by inter-class correlation above .70; and at least two forms of evidence of concurrent/predictive or convergent validity.

4.3 Methods

4.3.1 Participants and procedure

Data used in this study were collected as part of the on-going U-Change (Understanding & Characterising Healthy Adolescent-to-Adult Neurodevelopmental Growth Effects) arm of the Neuroscience in Psychiatry Network (NSPN) (NSPN.org.uk) (Kiddle et al., 2017;

St Clair et al., 2017). The sample size at the time at which this analysis was conducted included 2,432 participants (age in years: M=19, SD=3, range=14-25; 54% girls). The main sampling frame was age-sex-registers of patients registered in general medical practices in two British regions (Cambridgeshire and Peterborough, and north London). The Primary Care Research Network arranged for invitation letters to be sent by GPs to eligible individuals on the study's behalf. Further recruitment involved direct visits to secondary schools and colleges by the recruitment team. A minority were recruited directly through the NSPN website (www.nspn.org.uk). The aim was to have 200 participants in each of the ten gender-age bins (14/15, 16/17, 18/19, 20/21, 22/23/24), a target that was exceeded for all bins. Informed consent was obtained for all participants over 16. Informed assent was obtained for all participants under 16 as well as informed consent from their parent/guardian. Participants who completed the first questionnaire package were sent another questionnaire package comprising the same instruments one year later. All recruitment was carried out by researchers other than myself.

4.3.2 Measures

Positive parenting: the *Positive Parenting Questionnaire* (PPQ) is a child/youth self-report questionnaire comprising 26 statements about a wide range of aspects of positive parenting as perceived by the child/youth, to which the respondent can indicate *always*, *mostly*, *sometimes*, or *rarely*. Participants were asked to rate how often each statement usually happens or used to happen when they lived at home. For a full list of items, see Table 4.1. Items are related not only to positive parenting in general, but also to the concept of attachment, assessing the child's confidence that their parents will respond to their needs, both emotional (e.g. Item 5) and physical (e.g. Item 4). Additionally, items cover the areas indicated by Alderfer and colleagues (Alderfer et al., 2008) as important in an instrument of child-parent relationships satisfaction, namely: family organization (e.g. Item 2), cohesion (e.g. Item 1), communication (e.g. Item 6), affective environment (e.g. Item 10), and problem solving ability (e.g. Item 24). Some items are more general (e.g. Item 11), while others are fairly specific (e.g. Item 19). The PPQ was developed by Professor Ian Goodyer (Chief Investigator of the NSPN stud) and has good face validity but it has not been otherwise validated.

Other measures of parenting: several pre-existing measures of parenting were used as indices of the PPQ's convergent validity.

The short form *Alabama Parenting Questionnaire* (APQ) (Elgar, Waschbusch, Dadds, & Sigvaldason, 2007) comprises 15 items about parenting style. It provides five sub-scale scores: positive parenting, inconsistent discipline, poor supervision, parental involvement, and corporal punishment. This instrument was developed and validated as a parent report measure, however in the present study it was completed by the participating adolescent about their parent. Nevertheless, internal consistency on each scale ranged from acceptable to excellent (α =.66 to .91).

The *Measure of Parenting Style* (MOPS) questionnaire (Parker et al., 1997) is a 15 item self-report measure comprising three subscales: indifferent, over-controlling, and abusive parenting. The 15 items are repeated separately for the adolescent's relationship with their mother and father. This instrument was developed and validated with an adult sample and its validity with adolescents is therefore unclear. It has however been used to show retrospective links between parenting styles and suicide attempts among women (Alanko et al., 2008), and psychiatric symptoms among people who exhibited gender atypical behaviors as children (Ehnvall, Parker, Hadzi-Pavlovic, & Malhi, 2007). The subscales show adequate internal consistency in the present sample (alphas = .67 - .93).

Parental education was coded separately for each parent based on the responses regarding age the parent left secondary school, and how many more years of full-time education were subsequently completed.

NSSI: the binary question, 'Have you ever tried to hurt yourself on purpose without trying to kill yourself?' from the *Drug, alcohol and self-injury* questionnaire (DASI) was asked at both baseline and follow-up. For further details of the DASI, see Section 3.2.2.

Psychological distress: a general distress factor was derived from a multi-instrument bi-factor model of self-reported thoughts, feelings and behaviours in adolescents and young adults (St Clair et al., 2017). The instruments used in deriving this bi-factor model were: the *Mood and Feelings Questionnaire* (Costello & Angold, 1988), a 33-item self-report

measure of symptoms of depression; the *Revised Children's Manifest Anxiety Scale* (C. R. Reynolds & Richmond, 1978), a 28-item self-report measure of symptoms of anxiety; the Revised *Leyton Obsessional Inventory* (Bamber, Tamplin, Park, Kyte, & Goodyer, 2002), an 11-item self-report measure of obsessive compulsive disorder symptoms; the *Antisocial Behaviour Questionnaire*, an 11-item self-report measure consisting of items regarding participants' violation of social norms, destructive behaviours, violence towards other, and lying and stealing; the *Rosenberg Self-Esteem Scale* (Rosenberg, 1965), a 10-item self-report measure of self-esteem; the *Warwick-Edinburgh Mental Well Being Scale* (Tennant et al., 2007), a 14-item self-report measure of general wellbeing. Internal validity for all of these measures ranged from good to excellent (αs = .74 to .95). A further 11 items were included from the 74-item Schizotypal Personality Questionnaire (Raine, 1991), which is self-report measure of the symptoms of the DSM-III diagnosis of Schizotypal Personality Disorder. These items were selected on the basis of comparisons with the semi-structured PLIKS interview (Horwood et al., 2008), which assesses 12 core psychotic symptoms. While not all of the above instruments and items explicitly assess psychological distress, factor analysis accounts for more obliquely related items by weighting them lower in computation of the final factor score. It is worth noting, however, that several of the above instruments were designed to measure correlates of distress, as opposed to distress itself. Nevertheless, these items provide valuable statistical information about the general distress construct, either directly or as proxy measures, regardless of whether that is what they were designed to assess. Further evidence of the convergent validity of this general distress factor with more explicit and face valid measured of distress can be found in St. Claire et al. 2017. The best fitting solution from these analyses comprised a general distress factor underlying all instruments, which accounted for 77% of the variance, as well as five specific non-correlated factors: self-confidence, antisocial behaviour, worry, aberrant thinking, and mood. In the present thesis only general distress will be used. These bi-factor analyses were conducted by researchers other than myself: for further details see (St Clair et al., 2017).

Friendships: for further details of the *Cambridge Friendship Questionnaire*, see section 3.2.2.

Socioeconomic status: participants' postcodes were used to generate *Indices of Multiple Deprivation* (T. Smith et al., 2015) as an indicator of socioeconomic status.

Impulsivity: the *Barratt Impulsivity Scale* (BIS) (J. Patton & Stanford, 1995) is a self-report measure that yields scores for motor impulsivity, nonplanning impulsivity, and attentional impulsivity, as well as a single total impulsivity score. It has been well validated, and widely used, including in investigations of NSSI (Hamza et al., 2015). For further details, see Section 2.5.1.

4.4 Analysis procedure

As the PPQ is a new measure, analyses were conducted with a bottom-up theory-free approach in order to determine the underlying factor structure and validity of the measure as indicated by the data. Responses to each PPQ item were examined for skew, kurtosis, response variability, and inter-item correlations. If any items were correlated above .90 they would be examined for redundancy, and if meaningfully similar, only one item would be retained. If any item had greater than 90% endorsement of a single category, it also would be excluded for showing insufficient variability. Items were also analysed with a graded response model of item response theory to see if any items provided insufficient information to be retained.

The total sample was randomly split into two equal sized groups, with one group being used for parallel analysis (PA) and exploratory factor analyses (EFA) and the other being used for confirmatory factor analyses (CFA). Final confirmatory analyses were conducted on the full sample. For CFA and EFA, the WLSMV (Weighed Least Square for categorical data mean and variance adjusted) estimator was used, which is the most accurate estimator for categorical variables (Barendse, Oort, & Timmerman, 2015). Parallel analyses were conducted using fa.parallel from the psych package for R (Revelle, 2011). EFA and CFA were performed in MPlus version 7.2. Descriptive statistics,

discriminant validity, and all other analyses were conducted in STATA 14 (StataCorp, 2015).

4.4.1 Exploratory analysis

While many researchers have relied on model fit indices for determining the number of factors to retain with categorical data, this approach has several shortcomings. In data where factor loadings are high, as observed with the PPQ, fit indices, in particular RMSEA (Root Mean Square Error of Approximation) and SRMR (Standardized Root Mean Square Residual), have a tendency to underestimate fit of models with only minor misspecifications (Browne, MacCallum, Kim, Andersen, & Glaser, 2002; Heene, Hilbert, Draxler, Ziegler, & Bühner, 2011). The accuracy of CFI (Comparative Fit Index) and TLI (Tucker-Lewis Index) as fit indices with categorical data is unclear (Garrido, Abad, & Ponsoda, 2016). All fit indices, particularly Chi Square but also TLI and CFI, are also especially inaccurate with skewed categorical data (Curran, Bollen, Paxton, Kirby, & Chen, 2002; Savalei & Rhemtulla, 2013), as is the case with the PPQ. Under these circumstances, fit indices tend to indicate more factors than exists in the population or are found with un-skewed data (Garrido et al., 2016). In general, however, CFI and TLI have been shown to demonstrate the greatest differential accuracy in the estimation of the number of factors with categorical variables of any of the fit indices, followed by RMSEA, and then SRMR, which was very inaccurate.

In Horn's parallel analysis (Horn, 1965), factors are retained if their eigenvalues from EFA or PCA (Principal Components Analysis) are greater than the average of those of randomly generated datasets in which variables are uncorrelated at the population level. Horn's PA is arguably the most accurate existing method for identifying dimensionality in continuous data (Henson & Roberts, 2006), and with categorical data is a more accurate indicator of dimensionality than fit indices (Garrido et al., 2016), particularly where variables were skewed, as they are in the PPQ. Therefore, Horn's PA was conducted on ten randomly computed polychoric correlation matrices with data from the first half of the full sample in order to determine the number of factors to be pursued with EFA and CFA. Glorfeld's extension (Glorfeld, 1995), using the 95th percentile rather than

the mean of the generated eigenvalues, was used for comparisons.

Two additional PA were conducted in STATA 14; eigenvalues from PCA were compared against the mean eigenvalues of ten randomly computed Pearson correlation matrices using the user written programme, fapara; Horn's (1965) PA was conducted on Pearson correlations with Glorfeld's (1995) extension using the user written programme, paran (Dinno, 2009).

EFA of the models suggested by the PA were then conducted using the oblique promax rotation method on the same half of the sample. Other rotations were tested as well, however the oblique promax rotation yielded the most interpretable results.

4.4.2 Confirmatory analysis

CFA of the models suggested by the EFA were conducted on the second half of the sample. In keeping with recommendations (Stevens, 2009), only items loading above .40 in the EFA were included on CFA factors. The PA and EFA were re-run if several items required deletion from the model. Where an item loaded on more than one factor and the discrepancy between loadings was greater than .30, the item was included only on the factor on which it loaded more strongly; if the discrepancy was less than .30 the item was included on both factors in the initial CFA model. Items were subsequently deleted from the factors if they were non-significant, or loaded substantially (.30) higher on one factor than another, particularly if the lower cross loading did not theoretically fit with the other indicators on the factor. Items were added individually to factors as suggested by modification indices with a chi square change above 99 only if their addition made theoretical sense. A cut-off of 99 for chi square changes was appropriate given large sample size (St Clair et al., 2017). Non-significant and low loadings were evaluated, removing all non-significant loadings, loadings that were substantially lower than loading of all other items on a given factor, and cross-loadings that were substantially lower than the item's loading on another factor, particularly if doing so made theoretical sense within the model. Modification indices were also examined for any correlated errors between individual items indicating potential redundancy. Any redundant items would be removed, however no items had correlated errors with modification indices above the

chi-square change threshold of 99. This process was repeated until no further meaningful modifications were suggested.

The resultant model was then tested with CFA on the whole sample and the above procedure was repeated. Finally, age was added as a grouping variable in order to partially control for recall effects for those who were no longer living with their parents, and to see if the final model was valid across the age span of this sample. If further modifications were suggested for any of the age groups they were pursued with the same procedure as above, producing the final model. Both EFA and CFA models were examined for theoretical interpretability and adequate model fit, defined as: CFI > .95, TLI > .95, RMSEA < .05 (Garrido et al., 2016).

4.4.3 Bi-factor analysis

Bi-factor analysis was performed in order to determine if a general-specific model would show superior fit and validity to the CFA model, given that the PPQ was designed to measure a single construct, namely positive parenting. A three-factor bi-factor (one general, two specific) EFA was conducted on the first half of the sample using the bi-geomin rotation method where all factors were set to be uncorrelated with each other. This three-factor (one general, two specific) model was explored as having been suggested by both PA and the analyses outlined above. The method followed for these analyses was the same as that for the standard CFA reported above except that, as the inclusion of a general factor reduces loadings on specific factors, a lower cut-off of .25 on the bi-factor EFA was used for the specific factors in creating the CFA model.

4.4.4 Sum scores

As subscale item sum scores are more likely to be used by future researchers than factor scores (they are simpler to generate, and do not require a large sample size, for example), sum scores of items comprising each CFA factor were calculated as subscales. Given high correlations between factors, I also tested the psychometrics of a PPQ total sum score. For this total sum score, item 22 (I was cared for when physically unwell), which was excluded from EFA/CFA and bi-factor models, was included as it had a high item-

total correlation (.59) and its removal did not affect the overall Cronbach's alpha of the scale. Item total correlations for the total sum score range from 0.45 (item 19) to 0.84 (item 11). Subscale and total sums were calculated for participants with 85% non-missing data across subscale items, with within participant subscale mean substitution used for missing data. Response categories '*rarely*' and '*sometimes*' were not merged for creating subscale and total sum scores.

4.4.5 Reliability

Internal consistency of each of the PPQ subscales from the CFA was measured with Cronbach's alpha. Stability of the PPQ subscales and the general and specific factors was explored with intra-class correlations across times 1 and 2.

4.4.6 Discriminant and convergent validity

Pearson correlations between the PPQ and other baseline measures of parenting and attachment, as well as SES, parental education and adolescent friendships were used to test the discriminant and convergent validity of the PPQ.

4.4.7 Predictive validity

NSSI and psychological distress at T2 were used to test the predictive validity of the PPQ as both have been robustly prospectively linked to child-parent relationship quality (Fliege et al., 2009). Point-biserial correlations and logistic regressions were used to compare the predictive validity of baseline PPQ with other measures of parenting and attachment from the same sample in predicting psychological distress and NSSI at T2.

4.4.8 Gender and age differences

Gender, age, and gender by age interactions with the PPQ were investigated with independent linear regressions.

4.5 Results

All PPQ items were correlated with each other below .80. Results from the graded response model of item response theory indicated that all items provided significant information to be retained. Most PPQ items were negatively skewed. There was low endorsement of the lowest category (*rarely*) ranging from less than 1% endorsement on item 18, to 15% on item 6. In order to adjust for this, endorsement of either *rarely* or *sometimes* were combined into a single category. Analyses were also run using the original categories, and results were similar. However, multiple group CFA by age could not be conducted on these data because the first category of some items was unendorsed in certain age groups. As such, the final models produced with the original categories, although structurally similar to the model reported below, had poorer fit. Analyses on the original categories will not be reported further. Descriptive statistics of PPQ items with the first two categories merged are displayed in Table 4.1.

Table 4.1
Descriptive statistics of individual PPQ items after merging '*rarely*' and '*sometimes*'

Item	n	m	sd	Skew	Kurtosis
1. We spent quality time together.	2412	1.66	0.73	0.62	2.11
2. They attended school and social events which were important to me.	2414	2.17	0.82	-0.33	1.56
3. I received physical affection (lots of hugs etc.).	2412	1.97	0.84	0.06	1.41
4. I knew they would come and get me from places if needed.	2415	2.46	0.74	-0.98	2.49
5. They comforted me when I felt sad.	2411	2.23	0.82	-0.44	1.64
6. If I was angry I was still listened to.	2417	1.87	0.81	0.25	1.56
7. They praised me when I did well.	2417	2.28	0.79	-0.54	1.79
8. My ideas and interests were encouraged and supported.	2418	2.21	0.80	-0.41	1.67
9. I felt I was a priority to them.	2414	2.25	0.80	-0.48	1.73
10. I felt loved by them.	2417	2.55	0.69	-1.24	3.15

11. I felt listened to.	2416	2.17	0.82	-0.33	1.55
12. I could contact them whenever I needed to.	2416	2.54	0.70	-1.20	3.04
13. My home was safe and secure.	2416	2.74	0.55	-2.03	6.09
14. My opinions were valued.	2415	2.17	0.82	-0.32	1.57
15. We talked about things I considered important.	2412	2.14	0.83	-0.28	1.52
16. My privacy was respected.	2414	2.14	0.80	-0.26	1.61
17. My friends were welcomed in our home.	2415	2.44	0.74	-0.90	2.27
18. I was provided with clothes, toys, and other equipment I needed.	2414	2.77	0.51	-2.14	6.74
19. I was given pocket money.	2414	2.27	0.86	-0.56	1.58
20. I could ask for things without difficulty.	2418	2.17	0.80	-0.32	1.61
21. I was encouraged to achieve.	2420	2.71	0.59	-1.89	5.37
22. I was cared for when physically unwell.	2423	2.75	0.53	-1.98	6.02
23. I learned skills from them.	2425	2.39	0.76	-0.78	2.14
24. I received helpful advice to problems or questions I had.	2424	2.33	0.78	-0.64	1.94
25. I was encouraged to learn at school.	2423	2.76	0.54	-2.24	6.91
26. An interest was taken in my educational progress.	2421	2.68	0.62	-1.78	4.82

4.5.1 Exploratory analyses

PA with the polychoric correlation matrices indicated that the number of factors for the PPQ was five and the number of components was three. The three, four, and five-factor models were all examined. The three-factor model was the most theoretically interpretable and also the most parsimonious model with adequate fit: CFI > .95, TLI > .95 (Garrido et al., 2016), RSMEA above 0.05 and less than 0.08 (MacCallum, Browne, & Sugawara, 1996). As such, the three-factor model was pursued further. Fit indices for

the 3-factor EFA on the test half of the sample are shown in Table 4.2. Results of EFA on this model are shown in Table 4.3. As item 22 loaded below .40 on all three factors, it was dropped from subsequent analyses. PA were rerun without this item but results were unchanged. All other items loaded above .40 on at least one factor and were therefore included in CFA.

Table 4.2
Fit statistics for models tested in EFA / CFA and bi-factor EFA / CFA

	CFI	TLI	RMSEA	RMR	Chi^2	df
EFA/CFA						
EFA (test half)	0.95	0.99	0.07	0.04	931.12	142
Initial CFA (confirmatory half)	0.93	0.99	0.08	1.81	1147.21	132
Final CFA (whole sample)	0.96	0.99	0.07	2.79	1830.76	543
Bi-factor						
EFA (test half)	0.98	0.98	0.06	0.04	1273.02	228
Initial CFA (confirmatory half)	0.93	0.99	0.08	1.75	1126.31	133
Final CFA (whole sample)	0.96	0.99	0.06	2.60	1640.60	556

4.5.2 CFA

Items 1 through 17, and item 24 loaded on factor 1. These items reflect parental support and secure attachment ('Support'). Factor 2 comprised items 21, 23, 24, 25, and 26, which measure motivation to achieve ('Motivation'). Factor 3 comprised items 18, 19, and 20, which are related to parental generosity ('Generosity'). This model was tested with CFA on the second half of the sample. Modification indices suggested that item 24 be removed from Factor 1 (Support) as it loaded significantly lower on this factor than on Factor 2 (Motivation), and also loaded lower than did other items on Factor 1. No further modifications were suggested. This revised model was then rerun on the whole sample. Modification indices suggested that item 17 be included on Factor 3 (Generosity). After this addition, item 17 no longer loaded onto Factor 1 and was removed from that dimension. No further meaningful modifications were suggested. Standardised YX factor estimates from this model ranged from 0.61 to 0.96. Adding age groupings to this final

model improved model fit and did not result in any further modifications. Fit for this model was adequate on the whole sample, shown above in Table 4.2.

Table 4.3
Factor loadings from initial EFA

Item summary	Factor 1 (Support)	Factor 2 (Motivation)	Factor 2 (Generosity)
1. Quality time.	**0.67**	0.08	-0.01
2. Attended events.	**0.47**	0.15	0.17
3. Physical affection.	**0.63**	0.05	0.11
4. Come and get me.	**0.47**	0.03	0.31
5. Comforted me.	**0.83**	0.02	0.07
6. Listened to me	**0.91**	-0.08	-0.01
7. Praised me.	**0.75**	0.07	0.08
8. Ideas supported.	**0.81**	0.06	0.02
9. I was a priority.	**0.78**	0.01	0.15
10. I felt loved.	**0.79**	0	0.18
11. I felt listened to.	**0.98**	-0.07	0.01
12. Could contact.	**0.63**	0.04	0.21
13. Safe home.	**0.47**	0.19	0.25
14. Valued opinions.	**1.01**	-0.08	-0.06
15. Talked.	**0.97**	-0.06	-0.04
16. Privacy respected.	**0.66**	-0.16	0.19
17. Friends welcome.	0.43	-0.03	**0.35**
18. Necessities provided.	0.02	0.05	**0.82**
19. Given pocket money.	-0.02	0.01	**0.74**
20. Could ask for things.	0.27	-0.01	**0.65**
21. Encouraged to achieve.	0.02	**0.80**	0.17
22. Cared for when unwell.	0.30	0.38	0.23
23. Skills learned.	0.33	**0.60**	-0.01
24. Helpful advice.	0.52	**0.48**	-0.04
25. Encouraged to learn.	-0.06	**0.93**	0.13
26. Interest in education.	0.09	**0.75**	0.14

Factors on which items are included in final CFA shown in bold

4.5.3 Bi-factor analyses

As the CFA procedure produced models in which factors were highly correlated and the majority of items loaded onto a single factor, bi-factor analysis was deemed appropriate.

The three-factor model (one general, two specific) was explored as having been suggested by both PA and the analyses outlined above. A four-factor model (one general, three specific) was also examined, but as it was less interpretable and had problems with convergence in CFA, it will not be reported on further. Bi-factor analyses were conducted both with and without item 22, which had been excluded from the CFA. Although item 22 loaded significantly onto the general factor in bi-factor EFA, CFA with this item had significantly poorer model fit and problems with convergence. Results of the bi-factor EFA and CFA without item 22 were superior and are reported below.

In bi-EFA, every PPQ item loaded significantly and above .40 on the general factor, shown in Table 4.4. The first specific factor (S.Motivation) contained the same items as the Motivation factor in the CFA. The second specific factor (S.Generosity) contained the same items as the Generosity factor in the CFA, apart from item 17. However, bi-factor CFA on the entire sample suggested one modification, that item 17 be included on specific Factor 2, making it match the Generosity factor derived from the CFA analyses reported above. Standardised YX factor estimates from this model ranged from 0.63 to 0.93 on the general factor, and from .27 to .69 on the specific factors. Adding age groupings to this final model improved model fit and did not result in any further modifications being suggested. Fit for this model was adequate on the whole sample and marginally better than fit for the standard CFA model (Table 4.2).

4.5.4 Internal Consistency and Stability

Table 4.5 shows Cronbach's alpha for the PPQ subscale item sums, and inter class correlations between the PPQ sums/factors at time 1 and time 2. Stability was good for all sums/factors, but was noticeably lower for the bifactor specific factors than other factors or sums. The model fit at time 2 remained adequate for both CFA (CFI = .96, TLI = .99, RMSEA = .08, WRMR = 2.59, Chi2 = 22826.45, df = 89) and bi-factor models (CFI = .97, TLI = .99, RMSEA = .07, WRMR = 2.48, Chi2 = 22826.45, df = 89), with no loadings below thresholds or modification indices above cut-off.

Table 4.4
Factor loadings from initial bi-EFA

Item summary	General factor	Specific 1 (Motivation)	Specific 2 (Generosity)
1. Quality time.	**0.71**	0.02	-0.15
2. Attended events.	**0.69**	0.08	0.01
3. Physical affection.	**0.73**	0	-0.06
4. Come and get me.	**0.71**	-0.01	0.11
5. Comforted me.	**0.87**	-0.03	-0.13
6. Listened to me	**0.83**	-0.09	-0.18
7. Praised me.	**0.84**	0.01	-0.10
8. Ideas supported.	**0.85**	0.01	-0.15
9. I was a priority.	**0.88**	-0.04	-0.06
10. I felt loved.	**0.90**	-0.05	-0.05
11. I felt listened to.	**0.92**	-0.09	-0.19
12. Could contact.	**0.80**	0	0.01
13. Safe home.	**0.77**	0.11	0.05
14. Valued opinions.	**0.89**	-0.09	-0.23
15. Talked.	**0.88**	-0.07	-0.21
16. Privacy respected.	**0.67**	-0.13	0.01
17. Friends welcome.	**0.66**	-0.03	**0.15**
18. Necessities provided.	**0.65**	0.04	**0.54**
19. Given pocket money.	**0.53**	0.03	**0.51**
20. Could ask for things.	**0.73**	0	**0.39**
21. Encouraged to achieve.	**0.71**	**0.57**	0.05
23. Skills learned.	**0.73**	**0.41**	-0.12
24. Helpful advice.	**0.82**	**0.33**	-0.17
25. Encouraged to learn.	**0.69**	**0.66**	0.03
26. Interest in education.	**0.72**	**0.53**	0.02

Factors on which items are included in final CFA shown in bold

Table 4.5
Descriptive and stability statistics for the PPQ total, CFA, and bi-factor scores

	Alpha	Mean	SD	Skew	Kurtosis	ICC
PPQ total sum	0.96	59.35	15.50	-1.01	3.60	0.76**
Subscale sums						
Support	0.95	34.38	11.01	-0.82	2.96	0.75**
Motivation	0.87	12.72	3.04	-1.72	5.84	0.71**
Generosity	0.71	10.18	2.43	-0.97	3.45	0.65**
CFA factors						
Supportive	---	-0.17	0.62	-0.15	2.66	0.72**
Motivation	---	-0.19	0.84	-0.32	2.79	0.71**
Generosity	---	-0.09	0.71	-0.22	2.66	0.70**
Bi-factors						
General factor	---	-0.16	0.63	-0.15	2.66	0.74**
S. Motivation	---	-0.10	0.42	-0.59	3.98	0.47**
S. Generosity	---	0.05	0.2	-0.30	3.01	0.48**

**. Correlation is significant at the 0.01 level (2-tailed).
S. refers to specific factor
ICC = interclass correlations between Time 1 and Time 2 scores

4.5.5 Factor correlations

Pearson correlations between CFA factors, bi-factors, subscale sum, and total sum scores are shown in Table 4.6. The PPQ total sum score was highly correlated with all three CFA factor scores, as well as with the general factor from bi-factor analysis. The CFA factor scores were very highly correlated with each other. The subscale sums were less correlated than the CFA factor scores, and therefore are less likely to be multicollinear if included together in a model.

The General factor was almost identical to the CFA Support factor (r = 1.00). As expected, the specific factors were each correlated most highly with their corresponding CFA factors and subscale item sum scores, yet the specific factors confer different meaning to their corresponding subscales (eg. S.Generosity specific factor reflects what remains when the influence of support is subsumed in the general factor, whereas the generosity subscale includes support). Given the high correlations between CFA factors (r = 0.83 - 0.90), further validation with other variables will likely yield similar results for

all CFA factors, posing problems of interpretability. Therefore, only the bi-factors and sum scores will be reported on further as these are less highly correlated.

Table 4.6
Pearson correlations between CFA factors, bi-factors, subscale sum, and total sum scores

1. Total sum	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**
Subscale sums									
2. Support	0.98**								
3. Motivation	0.84**	0.75**							
4. Generosity	0.74**	0.65**	0.55**						
CFA factors									
5. Support	0.95**	0.96**	0.73**	0.66**					
6. Motivation	0.89**	0.84**	0.90**	0.63**	0.90**				
7. Generosity	0.87**	0.82**	0.67**	0.90**	0.88**	0.83**			
Bi-factors									
8. General factor	0.95**	0.96**	0.73**	0.66**	1.00**	0.90**	0.88**		
9. S. Motivation	0.12**	-0.02	0.55**	0.10**	0.03**	0.43**	0.11**	0.03	
10. S. Generosity	0.11**	-0.02	0.08**	0.68**	0.02**	0.10**	0.48**	0.02	0.21**

**. Correlation is significant at the 0.01 level (2-tailed).
S. Specific factor

4.5.6 Convergent and divergent validity

All of the subscale sum scores, the total sum score, and the general factor were significantly correlated with each of the other measures of parental attachment and relationship quality, shown in Table 4.7. For the specific factors, there was more divergence: S.Motivation was related to more parental involvement, better support, increased paternal and maternal control, and higher parental education. Greater S.Generosity was related to less punishment, less maternal control and abuse, and better friendships.

Table 4.7
Correlations between PPQ scores and validation measures

	Total sum	Subscale sums			Bi-factor		
		Sup.	Mot.	Gen.	General	S.Mot.	S.Gen.
APQ							
Positive parenting	0.72**	0.73**	0.57**	0.45**	0.71**	0.03	-0.04
Inconsistent parenting	-0.15**	-0.16**	-0.11**	-0.11**	-0.17**	0	-0.02
Poor support	-0.36**	-0.36**	-0.29**	-0.25**	-0.37**	-0.06**	0.01
Involvement	0.68**	0.68**	0.58**	0.44**	0.67**	0.11**	-0.03
Punishment	-0.29**	-0.29**	-0.20**	-0.25**	-0.26**	0.03	-0.06**
Maternal MOPS							
Indifferent	-0.57**	-0.55**	-0.51**	-0.39**	-0.50**	-0.03	-0.01
Controlling	-0.41**	-0.43**	-0.24**	-0.35**	-0.41**	0.11**	-0.05**
Abusive	-0.51**	-0.50**	-0.41**	-0.40**	-0.46**	0.02	-0.06**
Paternal MOPS							
Indifferent	-0.46**	-0.45**	-0.40**	-0.31**	-0.40**	-0.05*	0.02
Controlling	-0.38**	-0.39**	-0.26**	-0.29**	-0.38**	0.05**	-0.01
Abusive	-0.45**	-0.44**	-0.36**	-0.33**	-0.41**	-0.01	-0.01
CFQ	0.37**	0.36**	0.28**	0.31**	0.36**	0	0.09**
Maternal Education	0.15**	0.14**	0.17**	0.09**	0.13**	0.10**	-0.02
Paternal Education	0.16**	0.14**	0.19**	0.12**	0.13**	0.14**	0.03
IMD	-0.12**	-0.12**	-0.09**	-0.09**	-0.11**	0.01	0

**. Correlation is significant at the 0.01 level (2-tailed).
Sup. Supportive
Mot. Motivation
Gen. Generosity

4.5.7 Predictive validity

The PPQ total sum score, the Support subscale sum, and the General bi-factor score had higher correlations with T2 NSSI and distress than the other PPQ subscales or other measures of parenting. The specific PPQ factor scores at T1 were not associated with T2 NSSI or distress. Pearson and point-biserial correlations between T1 relationship measures and T2 distress and NSSI are shown in Table 4.8.

Table 4.8
Correlations between T1 parenting measures and T2 distress and NSSI at T2 (n = 1504 – 1539).

	Distress	NSSI
PPQ total sum	-0.36**	-0.23**
PPQ subscale sums		
Support	-0.36**	-0.23**
Motivation	-0.30**	-0.20**
Generosity	-0.23**	-0.15**
PPQ bi-factors		
General factor	-0.36**	-0.21**
S. Motivation	-0.03	-0.03
S. Generosity	0.02	0.00
APQ		
Positive parenting	-0.28**	-0.18**
Inconsistent parenting	0.14**	0.06*
Poor support	0.14**	0.09**
Involvement	-0.24**	-0.13**
Punishment	0.13**	0.10**
Maternal MOPS		
Indifferent	0.28**	0.17**
Controlling	0.27**	0.13**
Abusive	0.23**	0.13**
Paternal MOPS		
Indifferent	0.24**	0.13**
Controlling	0.28**	0.11**
Abusive	0.25**	0.14**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

4.5.8 Gender and age differences

Table 4.9 shows results of separate linear regressions exploring the effects of gender, age, and gender by age interactions for each of the PPQ scores. The PPQ total sum and General score did not differ by gender or age. There was a significant interaction between gender and age for Motivation and S.Motivation, such that being older was significantly related to lower reported parental motivation (S.Motivation, $b = -.02$, $t = -4.17$, $p < .001$) for boys, but not for girls ($b = 0$, $t = -0.47$, $p = .642$). S.Generosity increased with age and

was greater among boys than girls (standardised mean difference = .26, t = 6.49, p < .001) and overall. Generosity was greater among boys, but there were no age effects.

Table 4.9
Unstandardized beta coefficients from separate linear regressions of age and sex predicting PPQ scales

	Sex	Age	Sex X Age
PPQ total sum	-0.01	-0.01	-0.01
Subscale sums			
Support	0.01	-0.01	-0.01
Motivation	-0.01	-0.01**	-0.02*
Generosity	-0.11**	0	0.01
Bi-factors			
General	-0.01	0	-0.01
S. Motivation	-0.05**	-0.01**	-0.02**
S. Generosity	-0.05**	0.01**	0

**. Beta coefficient is significant at the 0.01 level (2-tailed).
S. refers to specific factor

4.6 Discussion

Overall these findings support the validity and utility of a new instrument for measuring positive aspects of adolescents' relationships with their parents, the Positive Parenting Questionnaire (PPQ). Significant correlations between all items on the PPQ suggested that factor analyses would be both appropriate and useful for this instrument. The three factors suggested by the process of parallel analysis (PA), exploratory factor analysis (EFA), and confirmatory factor analysis (CFA), were meaningful and readily interpretable, and the model yielded acceptable fit. The first factor comprised the majority of PPQ items and represented a broad positive parenting factor, which I labelled Support. Items pertaining to emotional support, communication, validation, and security of both home and the child-parent relationship were included on this factor. The second factor comprised five items pertaining to the extent to which parents encouraged and took an interest in their children's achievement and academic attainment, which I labelled Motivation. The third factor comprised four items pertaining to how generous parents were with material resources, which I labelled Generosity. Based on high correlation

between factors, bi-factor analyses was warranted. The second two factors from the CFA model (Generosity and Motivation) comprised the same items as the two specific factors indicated in the bi-factor analyses, which had nearly identical model fit to the CFA. Moreover, the General factor and Support factor correlated very highly, although the General factor comprised 6 additional items. The stability of the factor structure is demonstrated by acceptable model fit in repeated measures data one year later. While the bi-factor model provided factors which were more orthogonal than the CFA factors, the subscale item sum scores from the CFA were not too collinear (r=.55-.75), and are more easily produced. These subscale item sum scores may therefore be more useful to future users of the PPQ. A sum score of all PPQ items was also calculated and tested because of its simplicity and theoretical interpretability despite a poor model fit in CFA.

The total sum, subscale sums, CFA factors, and bi-factor general score demonstrated good stability across time points (r = .65 - .75), showing equivalent stability to the APQ and MOPS in the sample (r = .54 to .75). The specific factor scores were more labile. The greater lability of the specific factors was unsurprising given that material and educational support are more likely to fluctuate with participants' age, discussed further below. The subscales and the total sum demonstrated acceptable to excellent internal consistency as evidenced by Cronbach's alphas.

The PPQ total sum, subscale sums, and bi-factor scores demonstrated good validity. The total sum, Support subscale sum, and General score were correlated with every other measure of child-parent and family relationships, indicating the convergent and criterion validity of these scales and the PPQ in general.

It is noteworthy that these scores were most highly correlated with the APQ positive parenting subscale, followed closely by the APQ involvement subscale. These two APQ subscales are the most theoretically closely related to positive parenting and the direction of associations were as anticipated, lending further support to the convergent validity of the PPQ total sum and the General score. The subscales were also all correlated with every other measure of child-parent and family relationships, likely due to their shared variance with Support. The specific factors from the bi-factor model showed the best

divergent validity in relation to the validity measures at my disposal. The specific Motivation factor was positively correlated with APQ involvement, maternal and paternal MOPS controlling parenting, and maternal and paternal education. Further, this specific PPQ factor was negatively related to APQ poor support and MOPS indifference. As constructs, parental support, involvement, education, and control are all conceptually closely related to motivation and encouragement to succeed both academically and more broadly, supporting the validity of this PPQ factor. That Motivation was significantly correlated with these validation measures and not with other less closely related measures such as positive, inconsistent, and abusive parenting, as well as punishment supports the divergent validity of this factor. The specific Generosity factor was negatively correlated with APQ punishment, maternal MOPS controlling and abusive parenting, and positively correlated with CFQ. Withholding resources or privileges, including spending time with friends and having friends over, could be used as a form of both punishment and control. Adolescents without pocket money will be less able to socialise and act autonomously in any situation where money is required. Depending on the extent to which necessary resources such as school supplies, clothes, and food are withheld, such deprivation could also constitute abuse. As such, the finding that Generosity was significantly negatively correlated with these other validation measures and not with less closely related measures such as parental education, or positive and inconsistent parenting, supports the divergent validity of this factor. Such divergent findings for the specific factors shows the utility of a bi-factor approach, which removes the variance shared with a general factor and gives 'purer' measures of specific aspects of parenting.

In order to test the predictive validity of the PPQ total sum, subscale sums, and bi-factor scores I examined their correlations, alongside those of the other measures of child-parent and family relationships, with non-suicidal self-injury (NSSI) and a measure of general distress one year later. The PPQ total sum, General factor, and the Support subscale sum showed equivalent or superior predictive validity of both distress and NSSI than did the other PPQ subscales sums, the specific factors, the APQ, or MOPS. The Motivation and Generosity subscale sums were both significantly correlated with future NSSI and distress, however the specific factors were not. This indicates that much of the

association between these latter subscale sums and future NSSI and distress may be accounted for by the variance the Motivation and Generosity subscales share with Support. The Motivation and Generosity subscales may nevertheless be useful in predicting other more closely related constructs, such as academic attainment and peer relations respectively.

While some other measures exist that are closely related to both the PPQ Generosity (e.g (Furnham, 2001) and Motivation subscales (for meta-analysis see (Hill & Tyson, 2009), the PPQ subscales may be advantageous for their brevity, for having been psychometrically validated, and as subscales nested within a measure of the larger construct of positive parenting. The PPQ total sum and General score may also be advantageous in that they may reflect a broader conceptualisation of positive parenting than existing alternatives such as the APQ positive parenting subscale. For example, the PPQ includes items related to child-parent communication (items 6, 11, 14, 15), relationship security (items 4, 9, 10, 12, 13), and emotional support (items 5 and 6), which are all important aspects of attachment (Ainsworth, 1989) that are absent from the APQ.

Having demonstrated the psychometric reliability of the PPQ subscale sum, total sum, and bi-factor scores, I investigated trends with gender and age. The PPQ total sum, Support subscale sum, and General factor were invariant across gender and age supporting the generalizability of these scores and the PPQ overall. The subscales showed similar age and sex trends to their corresponding general-specific factors. The only differences were that the Motivation subscale sum did not vary by sex, and the Generosity subscale did not vary by age, whereas their corresponding specific factors did. As the subscale scores share variance with Support, interpretation is less clear than for the bi-factor scores. The S. Generosity factor was greater among boys than girls and increased with age. That parents are more liberal with their older children, providing them with more resources and pocket money, is unsurprising. The transition through adolescence is characterised by growing independence, autonomy, and responsibility. The finding that parents are also less generous with their daughters than with their sons is likewise in keeping with existing literature; parents and children both report greater child-

parent conflict with adolescent daughters than sons, and parents are more restrictive of their daughters' freedom which can be seen as the inverse of generosity (Allison, Schultz, & Jerelyn B, 2004; Clark-Lempers, Lempers, & Ho, 1991; Smetana & Asquith, 1994). The Motivation factors showed a significant gender by age interaction such that being older was significantly related to lower reported parental motivation for boys, but not for girls. This finding too is in keeping with those of Allison and Schultz (Allison et al., 2004), who found that not only did school related issues yield higher child-parent conflict for boys than girls, but also that child-parent conflict across many domains declined significantly between ages 13 and 14 but only for boys. Thus, motivation and academic performance appear to be areas over which parents are particularly concerned for their sons, however this concern may decline as boys age.

4.6.1 Limitations

Most of the individual PPQ items were negatively skewed in this general population sample, with most participants endorsing positive parenting experience. Skew of some items was not fully corrected by combing the lowest two response categories (*rarely* and *sometimes*) posing a potential issue for parametric testing. Skew and kurtosis are also issues for other widely used parenting measures, including both the Measure of Parenting Style questionnaire (Parker et al., 1997) and the Alabama Parenting Questionnaire (Elgar et al., 2007). As all items are in the PPQ are positively worded, it should potentially be administered in conjunction with a response bias measure.

It is also noteworthy that item 22 did not load above the threshold of .4 on any of the EFA factors and was therefore dropped from subsequent factor analyses. Item 22 was, however included in the PPQ total sum as neither modification indices nor reliability statistics indicated it should be dropped. Thus the factor scores/subscales sums and the total sum score did not comprise an identical set of items. The validity of including item 22 in the PPQ total sum may warrant further investigation.

Finally, while the PPQ total sum score demonstrated good convergent and predictive validity, and internal reliability, the single factor model did not meet criteria for good model fit. The total sum score did, however, perform well and made theoretical sense.

The total sum score was, moreover, very highly correlated with the general score from the bi-factor model, which did have adequate model fit. The high correlation between the general score and total sum helps support the validity of the latter, as does its high Cronbach's alpha, convergent and predictive validity, and stability across time points.

4.7 Conclusion

In this chapter I presented a psychometrically sound, reliable, and valid measure of positive parenting. Overall, both the 3-factor and the bi-factor model of the PPQ demonstrated acceptable model fit. The PPQ total sum, subscale sums, and factor scores showed good convergent validity, and internal reliability. The total sum, Support subscale sum, and General factor demonstrated good criterion, and predictive validity as well. However it appears that much of the predictive validity of Generosity and Motivation subscales in regards to NSSI and distress can be accounted for by the variance these PPQ subscales share with Support. Although a three factor model or a bi-factor model with two specific factors were suggested by the procedure of PA, EFA, and CFA, the total sum had the highest Cronbach's alpha of any of the PPQ scales, was highly correlated with the general factor and Support, and showed equivalent if not superior predictive validity to any of the other PPQ scores. As such, unless there is an a priori theoretical reason why motivation and generosity would be particularly relevant to the research question under investigation, the total sum may be both the most parsimonious and informative score that can be derived from the PPQ. Nevertheless, the specific Motivation and Generosity scales may be useful additions to the field in that they are both brief and psychometrically valid, having demonstrated good reliability and convergent and divergent validity. Motivation and Generosity may also demonstrate better predictive validity than general positive parenting with constructs with which these two subscales are more closely related such as child scholastic aptitude or parental liberality respectively. This possibility warrants further investigation. Regardless, the PPQ fills a need for psychometrically valid measures aimed towards assessing positive as opposed to dysfunctional parenting, and

will be used in subsequent chapters to explore the role of positive parenting in adolescent NSSI.

Chapter 5

Longitudinal associations between risk factors and NSSI

Psychological distress, child-parent relationships, and impulsivity have all been implicated in the aetiology of NSSI, however much of the research on these factors has been cross-sectional. Thus, the direction of these associations is unclear. In this chapter I will explore the directions of the associations between NSSI and proposed risk factors thereof using cross-lagged analyses of longitudinal data from the NSPN dataset.

Abstract

Background: Child-parent relationships, impulsivity, and psychological distress have been robustly associated with NSSI in cross sectional research, however the directionality of these relationships is unclear.

Methods: 1489 community-recruited adolescents (ages 14-25, m = 19) provided data on NSSI both at baseline and at a one-year follow-up. Adolescents' experiences of parenting were measured with the Positive Parenting Questionnaire and the Family Assessment Device, impulsivity was measured with the Barratt Impulsivity Scale, psychological distress was assessed with a multi-instrument measure of general distress, and NSSI was assessed with a dichotomous item on the Drug, Alcohol and Self-injury Questionnaire.

Results: Impulsivity and NSSI were both significantly predictive of each other, indicating that impulsivity may be both a risk factor and a consequence of NSSI. Likewise, both distress and NSSI were predictive of each other, in keeping with an emerging body of literature suggesting NSSI is both a response to distress and a risk factor for future distress. Positive parenting was predictive of but not predicted by NSSI, in keeping with the general assumption that family dysfunction is a risk factor for and not a consequence of NSSI.

Conclusion: Distress and impulsivity had bi-directional associations with NSSI, indicating that future research should either consider them as covariates of NSSI or take special steps to control/account for the effects prior NSSI might have on future reporting of distress and impulsivity. Poor child-parent relationships appear to be an unequivocal prospective risk factor for NSSI.

5.1 Possible directions of association between proposed risk factors and NSSI

While NSSI is often preceded by distress and followed by temporary relief (Klonsky, 2007; Nock et al., 2009), there is increasing evidence that NSSI is also predictive of future mental illness (Mars, Heron, Crane, Hawton, Lewis, et al., 2014; P. O. Wilkinson, 2015). Likewise, although self-reported impulsivity has been associated with NSSI in cross-sectional studies (Hamza et al., 2015; Liu et al., 2017), it is possible also that greater impulsivity is somehow a result of repeated engagement in NSSI. For example, young people with NSSI may become accustomed to impulsive behaviour by spending time with peers who also engage in NSSI and other impulsive activities, or people who engage in NSSI may score themselves more highly on impulsivity questionnaires because they think NSSI must be an impulsive action (Janis & Nock, 2009). Finally, while child-parent relationships are strongly associated with NSSI onset and persistence (Tatnell et al., 2014), distressed children such as those likely to be engaging in NSSI are more difficult to parent (Johnston & Mash, 2001) and may therefore receive less positive parenting. Thus a lack of positive parenting may be both a risk factor and a consequence of adolescent NSSI and its antecedents. Longitudinal analyses are necessary in order to clarify the direction of the associations between these risk factors and NSSI.

Hypotheses

Addressing the need for longitudinal studies of multiple risk and protective factors for new onset of NSSI, I set out to investigate the temporal relationships between NSSI and positive parenting, psychological distress, and impulsivity. Specifically, I predicted that higher levels of psychological distress, impulsivity, and lower levels of positive parenting increase risk for NSSI.

5.2 Methods

For details of NSPN participants, procedures, and measures, see Section 4.3.

5.2.1 Analysis procedure

Cross-lagged analyses using structural equation modelling were used to clarify the directions of the relationships between NSSI and each of the proposed risk factors: impulsivity, general distress, and positive parenting. Cross-lagged analysis tests the prospective association between one variable at time 1 on another variable at time 2 and vice versa, controlling for the mutual effects of both variables at time 1. Analyses were conducted using STATA, version 14 (StataCorp, 2015). A threshold of 5% was used for statistical significance, as predictor variables were correlated and only one primary outcome variable was used.

5.3 Results

5.3.1 Attrition

At baseline, 2291 (94%) participants reported on NSSI, of which 1489 (61%) provided data on NSSI at the one-year follow-up. Table 5.1 shows comparisons between those participants that provided NSSI data at both time points and the 802 that were lost to attrition. Participants with missing NSSI data at follow up were more likely to be boys, to have engaged in NSSI by T1, were more impulsive, reported less positive parenting, poorer family functioning, more deprivation, and more general distress, although effect sizes (Cohen's *d*) were small.

Table 5.1
Descriptive and comparison statistics between participants with (n = 1489) and without (n = 802) complete NSSI data

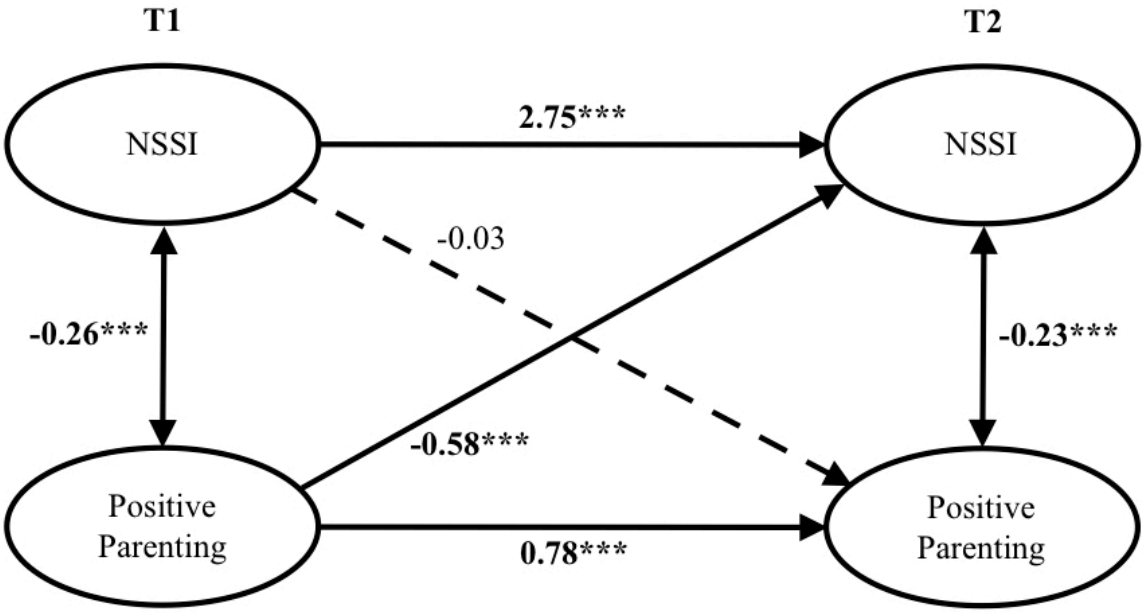
	Complete data		Missing data		Comparison statistics		
T1 variables	m	SD	m	SD	*smd*	t	*p*
Age	19.04	3.10	19.03	2.85	0	0.06	0.958
Positive parenting	2.32	0.58	2.22	0.61	0.18	4.35	<0.001
Family functioning	24.98	7.17	24.98	7.17	0.17	3.97	<0.001
General distress	-0.01	0.96	0.08	0.94	-0.09	-2.06	0.039
IMD	15.76	0.40	19.15	0.61	-0.24	-4.81	<0.001
Total impulsivity	61.01	9.82	63.94	10.14	-0.29	-7.11	<0.001

	N Yes	% Yes	N Yes	% Yes	% d	Chi²	*p*
NSSI	281	18.87	181	22.67	3.70	4.42	0.035
Male	626	42.04	417	52.00	9.96	20.82	<0.001

smd. Standardised mean difference
IMD indices of multiple deprivation

5.3.2 Cross-lagged analyses

Cross-lagged analyses showed that positive parenting at T1 predicted NSSI at T2 and not the reverse (Figure 5.1a). Impulsivity was both predictive of NSSI and predicted by it (Figure 5.1b). Likewise, distress was predictive of NSSI and predicted by it, however distress was a stronger predictor of NSSI than the reverse (Figure 5.1c).



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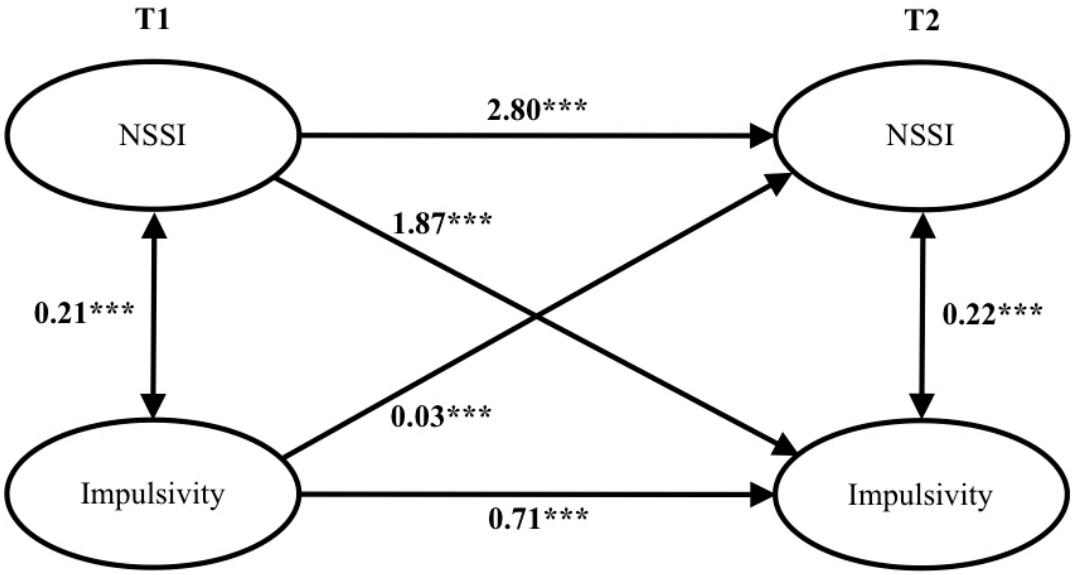

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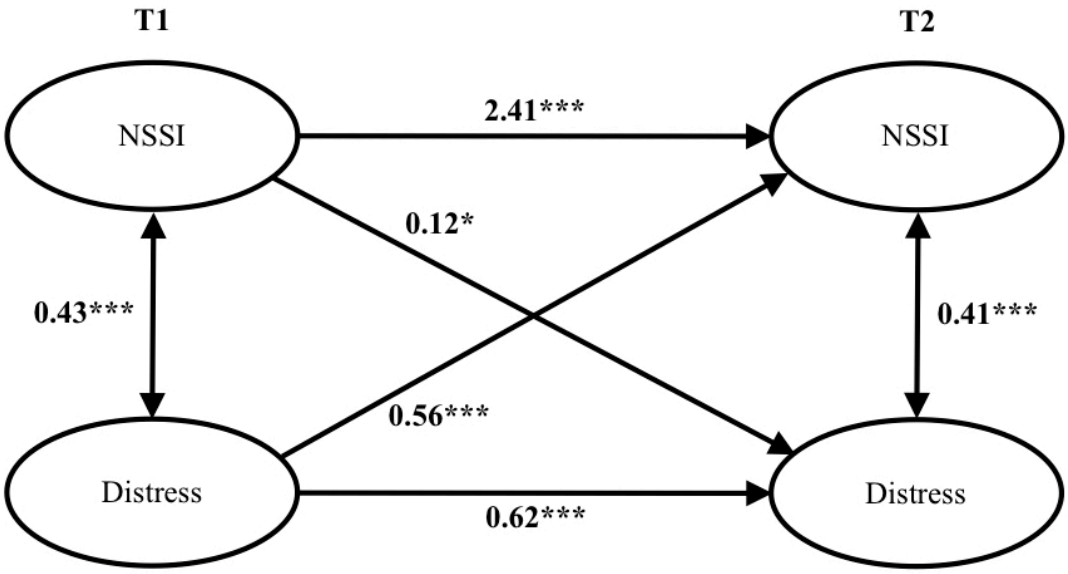


5.1c.

The models display standardized coefficients of the effects of risk factors (parenting, general distress, impulsivity) and NSSI at T1 on risk factors and NSSI at T2 controlling for their mutual effects. Pathways significant at $p < 0.05$ are shown with a solid line with coefficients in bold.

Figure 5.1. Path diagram of the cross-lagged analyses of the effect of NSSI and risk factors thereof at T1 on NSSI and risk factors thereof at T2 controlling for their mutual effects.

5.4 Discussion

In this Chapter I confirmed my hypothesis that adolescent NSSI is predicted by child-parent relationships, in this case a lack of positive parenting. Conversely, adolescent perceptions of positive parenting were not predicted by NSSI. Together these findings are in keeping with the existing body of literature on the prospective association between poor child-parent relationships on adolescent NSSI (Tatnell et al., 2014). Findings also justify models (used by other researchers and myself in subsequent chapters) in which child-parent relationship dysfunction is perceived as a risk factor for and not a consequence of NSSI.

The finding that impulsivity was both predicted by and predictive of NSSI is novel and problematic. The vast majority of research on the impulsivity-NSSI association has been cross-sectional (Hamza et al., 2015), but assumptions of directionality in which impulsivity is considered to be a risk factor for and not a consequence of NSSI are widely made. However the present findings demonstrate that the association between impulsivity and NSSI is bi-directional. Whether through neurotoxic effects of repeated NSSI, comorbidity with psychological distress, habituation to impulsive actions, inferences of impulsivity being made on the basis of NSSI engagement, or some other unknown mechanism, future impulsivity is independently predicted by NSSI. These findings demonstrate the importance of prospective studies in testing whether impulsivity may be causal for NSSI.

Likewise, the association between general distress and NSSI was found to be bi-directional, in keeping with an emerging body of literature suggesting NSSI is not only a response to acute distress but also predictor or warning sigh for future psychological distress (Mars, Heron, Crane, Hawton, Lewis, et al., 2014; P. O. Wilkinson, 2015). This highlights both the clinical importance of recognising and treating NSSI early, and also the methodological importance of robust longitudinal NSSI research with prospective designs.

5.5 Conclusion

In light of the bi-directional associations between NSSI and both impulsivity and distress, future research should either consider these factors as covariates of NSSI or take special steps to control/account for the effects prior NSSI might have on future reporting of distress and impulsivity. Findings support assumptions of directionality commonly made in cross-sectional research in which poor child-parent relationships are presumed to be a risk factor for NSSI.

Chapter 6

Pathways from positive parenting to NSSI

Having demonstrated the unidirectional prospective association between a lack of positive parenting as a risk factor for future adolescent NSSI (see chapter 7), in this chapter I will now explore some of the paths through which this association might operate, taking special care to control for the possible prospective effects of NSSI on proposed risk factors such as distress and impulsivity.

Abstract

Background: Child-parent relationships are robustly associated with NSSI, however, the reason for this strong association remains unclear. Positive parenting is associated with lower rates of both impulsivity and psychological distress, which have in turn both been implicated in the aetiology of NSSI. As such, reduced impulsivity and distress may mediate the association between positive parenting and lower rates of NSSI.

Methods: 1208 community-recruited young people (ages 14-25, m = 19, from the Neuroscience in Psychiatry Network cohort) with no lifetime NSSI were followed up for one year. Participants' experiences of parenting were measured with the Positive Parenting Questionnaire, impulsivity was measured with the Barratt Impulsivity Scale, NSSI was assessed with a dichotomous item on the Drug, Alcohol and Self-injury Questionnaire, and psychological distress was assessed with a multi-instrument measure of general distress.

Results: The association between positive parenting and lower rates of new onset of NSSI was mediated by lower reported psychological distress. Impulsivity independently predicted NSSI, and did not interact with distress or positive parenting.

Conclusion: Encouraging positive parenting may lessen young people's psychological distress and thereby reduce their risk of NSSI. Treating psychological distress directly will likely also reduce onset of NSSI; however risk for distress and NSSI may recur in the context of continuing lack of positive parenting. Improving impulse control may be another potential treatment target for preventing/reducing NSSI, however family focused therapy may be ineffective at reducing NSSI amongst individuals for whom impulsivity is a key factor in their NSSI engagement.

6.1 Pathways from parenting to NSSI

There are several pathways through which positive parenting might be prospectively associated with new onset of adolescent NSSI. Firstly, difficulties in relationships with parents are distressing (van Harmelen et al., 2016), and young people may respond to this distress by engaging in NSSI. Thus, distress may mediate the parenting-NSSI association (Hallab & Covic, 2010; Kimball & Diddams, 2007; Tatnell et al., 2014). Positive parenting may also moderate the distress-NSSI association, as positive child-parent relationships are associated with better coping skills (Moretti & Peled, 2004). Alternatively, parents may be a social resource in times of distress, only available to adolescents with positive child-parent relationships. Those without positive child-parent relationships may engage in NSSI as an alternative coping strategy when distressed (Nock & Prinstein, 2004). Thus distress and positive parenting may interact such that NSSI only occurs as a response to psychological distress in the absence of positive parenting.

Another way in which positive parenting may lead to NSSI is through its role in shaping impulse control. Positive parenting may promote the development of good impulse control (Londerville & Main, 1981), which is in turn associated with lower rates of NSSI. It is possible, given the apparently impulsive nature of this behaviour, that highly impulsive individuals are more likely to engage NSSI in order to reduce aversive symptoms, independent of overall levels of distress. Thus, impulsivity would have a direct association with NSSI and no interaction with distress. Alternatively, it is possible that neither distress nor impulsivity independently lead to NSSI, however, when they co-occur they may override adaptive behavioural controls (Mann et al., 1999). Thus, there would be an interaction between impulsivity and distress.

Impulsive and distressed children are, however, more difficult to parent (Johnston & Mash, 2001) and hence may receive less positive parenting. Thus longitudinal analyses are necessary in order to clarify the direction of the association between these factors.

Peer relationships may also moderate the distress-NSSI association in the same way as positive parenting. Further, peer relationships may moderate the parenting-NSSI

association, or vice versa, by acting as a substitute social resource when parents are unavailable (Cyr et al., 2014; Hazel et al., 2014).

Hypotheses

I set out to investigate the longitudinal associations between positive parenting, psychological distress, impulsivity, and NSSI. Specifically, I hypothesized that positive parenting could reduce the risk of new onset NSSI through:

I. Psychological distress as a mediator

II. Impulsivity as a mediator

III. Moderation of the impulsivity-NSSI association

IV. Moderation of the distress-NSSI association

V. Direct effect (through some mechanism not captured by these data)

Additionally, distress and impulsivity may contribute to increased NSSI independently and additively or only through combined interactive effects. As such, I also tested whether greater impulsivity moderated the association between distress and NSSI.

Finally, the role of peer relationships as either an independent prediction of NSSI or a moderator of the associations between NSSI and positive parenting or distress, was investigated.

6.2 Methods

Since my primary outcome variable is new onset of NSSI, the sample was restricted to participants that reported having never engaged in NSSI at the first wave of data collection in NSPN. This eliminates the risk of confounding presented by the bi-directional relationships between NSSI and both impulsivity and distress (see Chapter 5). For further details of NSPN participants, procedures, and measures, see Section 4.3.

6.2.1 Analysis procedure

As NSSI is theoretically more likely in individuals with antecedent higher distress levels and/or greater intrinsic impulsivity I examined the associations between these two factors and the subsequent first onset of NSSI. First, however, the effects of age, gender, and age by gender interactions in predicting NSSI were investigated with separate logistic regressions. Gender and participants' age were controlled for in all analyses where they were not the primary variables of interest. Next, point-biserial correlations were calculated between new onset of NSSI by T2 and positive parenting, general distress, and impulsivity at T1. In order to test the unique association of peer relationships over positive parenting in predicting NSSI, they were entered together in a multiple regression along with gender and age as covariates.

Next I investigated the direction of the associations between the proposed primary independent variable (positive parenting) and the other two independent variables of interest (impulsivity and distress) using cross-lagged analyses. In these analyses, the extent to which each independent variable at T1 predicted positive parenting at T2 controlling for the effect of positive parenting at T1 was contrasted with the extent to which positive parenting at T1 predicted each independent variable at T2 controlling for the effect of the independent variable at T1 using structural equation modelling (maximum likelihood estimator). These analyses tested the assumptions of causality necessary for the hypothesis model; individual differences in distress and/or impulsivity mediate the association between PPQ and subsequent emergence of new episodes of NSSI over a 12-month period. In the subsequent mediation analyses, variables predicted by positive parenting were entered as T1 mediators, and variables predictive of positive parenting were entered as T1 covariates along with sex and age. Mediation was tested using the user-written binary logistic mediation package (Ender, 2011) for Stata. Robust confidence intervals for direct and indirect effects were estimated using 2000 bootstrap repetitions.

I then tested the hypothesis that higher positive parenting moderates the associations between risk factors and NSSI. This was investigated with T1 PPQ-distress and PPQ-

impulsivity interaction terms predicting T2 NSSI in separate logistic regressions. Likewise, the hypothesis that the association between distress and NSSI is more pronounced among impulsive participants (and vice versa) was tested with interaction terms between distress and both the total impulsivity score and the impulsivity subscales at T1 predicting onset of NSSI by T2 in separate logistic regressions. The hypothesis that positive parenting moderates the association between poor peer relationships and NSSI or vice versa was investigated by an interaction term in logistic regression. Finally, the possibilities that T1 PPQ was differentially associated with NSSI onset by either gender or age were investigated using the same method. Analyses were conducted using STATA, version 14 (StataCorp, 2015). A threshold of 5% was used for statistical significance, as predictor variables were correlated and only one primary outcome variable was used.

6.3 Results

As there are predictors of missingness at T2 (see section 5.3.1) , data cannot be presumed to be missing at random, potentially biasing estimates (Sterne et al., 2009). Therefore multiple imputation of model variables using chained equations was conducted, producing 54 imputed datasets. The imputation model comprised all time points of all item-level data from the bifactor model, PPQ, BIS, NSSI, as well as background variables from Table 5.1 (179 variables in total), which predicted T2 NSSI and missingness in T2 NSSI. All analyses were performed on imputed T2 data based on complete baseline cases of those with no reported lifetime engagement in NSSI (n = 1686).

6.3.1 Univariate predictors of NSSI

Table 6.1 shows that lower positive parenting, better friendships, greater general distress, and higher impulsivity on all BIS subscales at T1 were significantly correlated (all $p < 0.02$) with new onset of NSSI by T2. As all three BIS subscales had similar correlations

with NSSI, only the total score will be used in analyses henceforth to limit the number of tests being conducted.

Table 6.1
Point-biserial correlations with new NSSI at T2

	r	p
Positive parenting	-0.10	<0.001
Friendships	-0.06	0.006
General distress	0.12	<0.001
BIS Attention	0.11	<0.001
BIS Motor	0.06	0.012
BIS Non-planning	0.08	0.004
BIS Total	0.11	<0.001

BIS Barratt Impulsiveness Scale
Controlling for gender and age

Girls were significantly more likely than boys to report engaging in NSSI within the past year at T2 (OR = 1.33, z = 2.86, p = 0.004). There was no significant effect of age (b = 0.15, z = 0.91, p = 0.363). The age by gender interaction was significant (b = 0.10, z = 3.14, p = 0.002), with boys being more likely to report NSSI if they were older (b = 0.07, z = 2.92, p = 0.003), whereas NSSI among girls was not associated with age (b = -0.03, z = -1.51, p = 0.132). Gender and age were specified as covariates in all further analyses.

6.3.2 Unique effects of friendships

The results of the multiple regression (see Table 6.2) show that peer relationships are not uniquely associated with first onset NSSI once positive parenting is accounted for. Positive parenting remains significantly predictive of first onset NSSI over and above friendship, gender, and age.

Table 6.2
Multiple regression results of friendships and parent attachment predicting NSSI

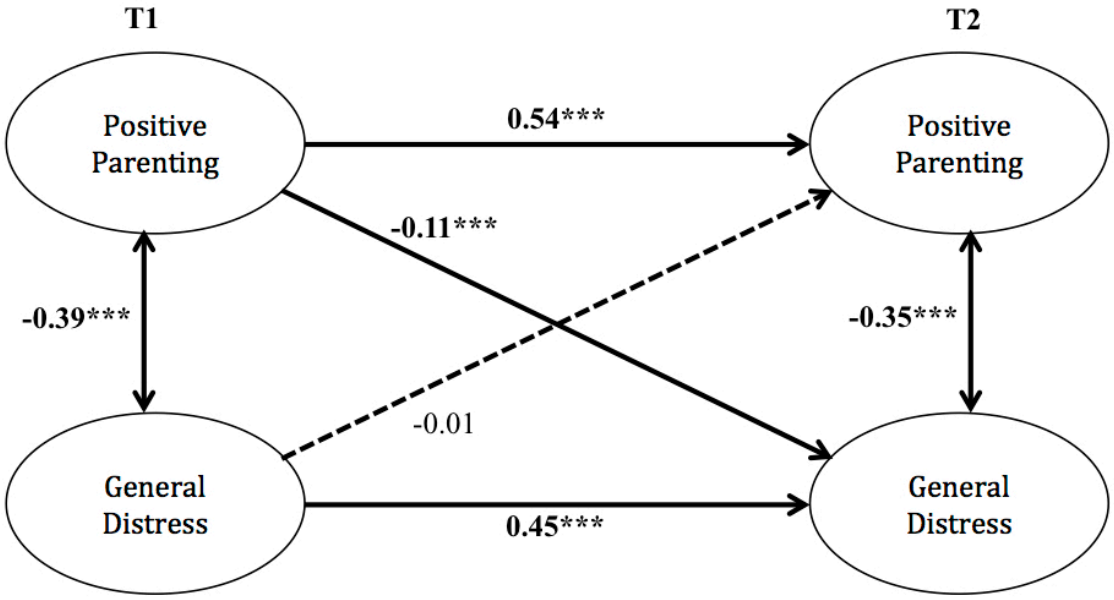
	beta	*SE*	*z*	*p*
Parent attachment	-0.75	0.23	-3.32	0.001
Friendships	-0.03	0.04	-0.96	0.337
Sex	-0.68	0.28	-2.45	0.014
Age	-0.16	0.04	-3.47	0.001

6.3.3 Moderation effects

The interaction terms between the impulsivity scales and general distress in predicting onset of NSSI were all non-significant (all $p > 0.10$). The interaction terms between positive parenting and general distress, impulsivity, gender, and age in predicting NSSI were likewise all non-significant (all $p > 0.10$). The interaction term between friendships and positive parenting was non-significant ($p = 0.198$).

6.3.4 Directions of relationships between risk factors for NSSI

Cross-lagged analyses showed that positive parenting at T1 predicted lower general distress at T2 and not the reverse (Figure 6.1a). As such, general distress at T1 was included as a potential mediator between positive parenting and NSSI in the subsequent mediation analysis. Cross-lagged analyses with positive parenting and impulsivity showed that neither variable at T1 significantly predicted the other at T2 (Figure 6.11b). Therefore, impulsivity was included as a covariate in the model, and not as a mediator.



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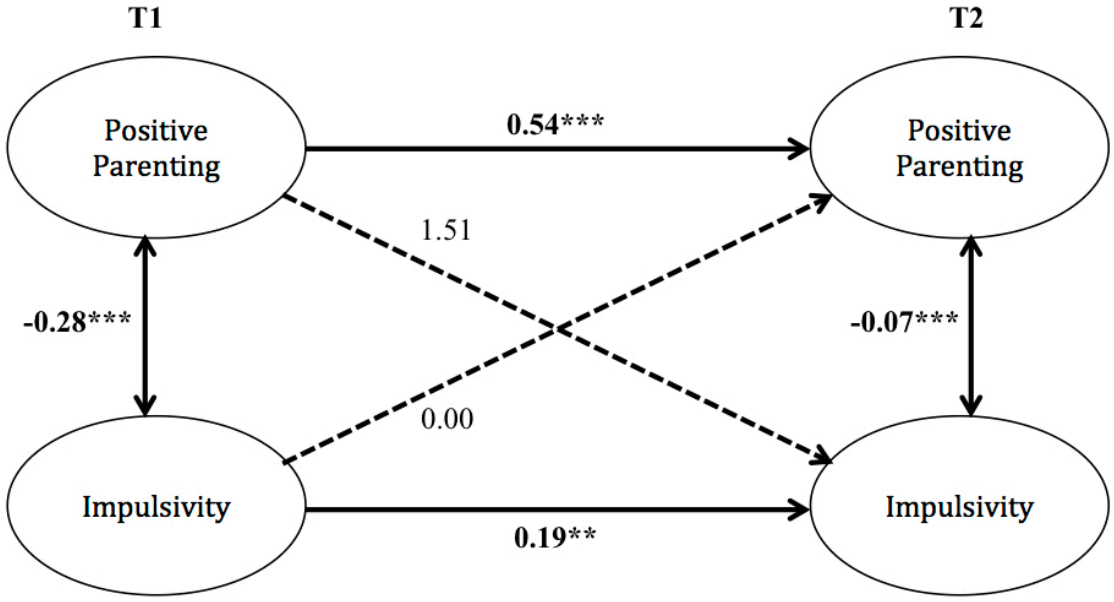


6.1b.

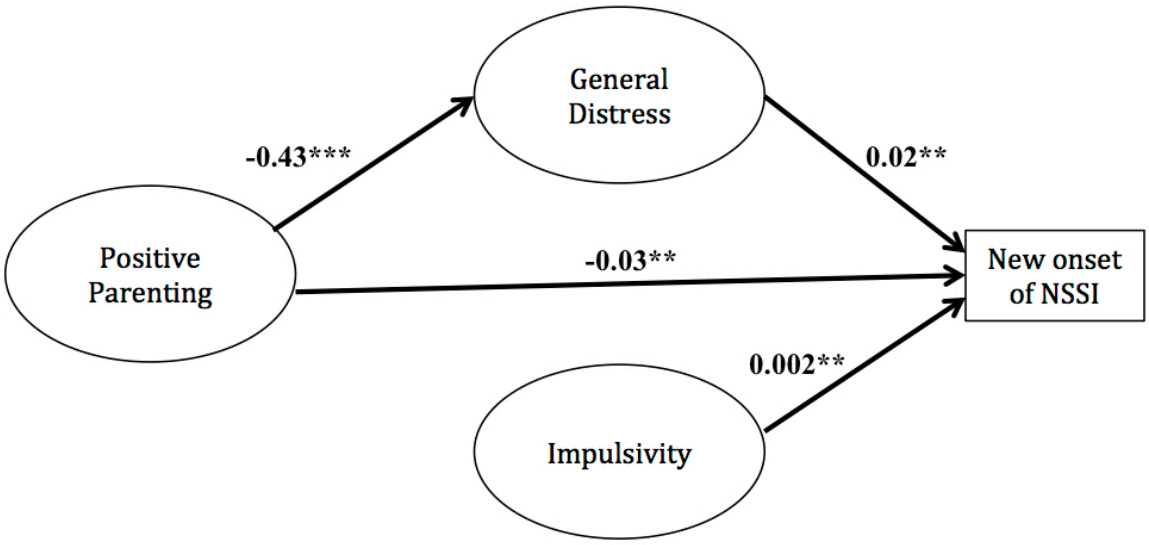
****.** Correlation significant at p < .01
*****.** Correlation significant at p < .001

The model displays standardized coefficients of the effects of positive parenting and general distress/impulsivity at T1 on positive parenting and general distress/impulsivity at T2 controlling for their mutual effects. Pathways significant at p < 0.05 are shown with a solid line with coefficients in bold.

Figure 6.1. Path diagram of the cross-lagged analyses of the effect of positive parenting and general distress/impulsivity at T1 on positive parenting and general distress at T2 controlling for their mutual effects.

6.3.5 A psychosocial model for new onset of NSSI

Direct effects from the binary logistic multiple mediation analysis are shown in Figure 6.2. The direct effects of T1 positive parenting, general distress, and impulsivity on new onset NSSI by T2 were all significant. Older age was an additional significant independent predictor of onset of NSSI (b = -0.005, t = -3.23, p = 0.001). Female sex was not associated with new NSSI (b = 0.02, t = 1.66, p = 0.097). The indirect effect of positive parenting on NSSI through lower general distress was also significant: bootstrapped estimate = -0.02, 95% CI = -0.03 - -0.01.



**. Correlation significant at p < .01
***. Correlation significant at p < .001

The model displays standardized coefficients of the direct effects of T1 positive parenting on T1 general distress, and of T1 general distress and impulsivity on new onset of NSSI by T2. Also shown is the direct effect of positive parenting on NSSI. Age, gender, and impulsivity were controlled for at every level of analyses. Pathways significant at p < 0.05 are shown with a solid line with coefficients in bold.

Figure 6.2. Path diagram of the mediation model of the effect of T1 positive parenting on new onset of NSSI over the next year, mediated by T1 general distress; independent effects of T1 impulsivity are included.

The above analyses with imputed data closely resemble full case analyses except on a few minor points. In full case analyses, the direct effect of positive parenting on NSSI was not significant (b = -0.13, 95% CI = -0.28 - 0.01). There were some different results

with sex and age; effects were always in the same direction (full details of complete case analyses can be found in Appendix B).

6.4 Discussion

In this chapter I demonstrated that the association between positive parenting and lower rates of new onset NSSI in young people with no prior histories of NSSI was mediated by lower general distress. I also found that while parenting was associated with distress one year later, the converse was not true. These findings are in keeping with a large body of literature demonstrating the broad impact of child-parent relationships on children's emotional wellbeing (DeKlyen & Greenberg, 2008), and replicate cross-sectional findings showing the same mediation pathway from child-parent relationship to NSSI through distress (Hallab & Covic, 2010). Positive parenting did not, however, moderate the effects of general distress on NSSI. Together, these findings suggest that positive parenting decreases rates of NSSI by reducing levels of psychological distress, which in turn reduces rates of new onset NSSI. However, positive parenting does not reduce the risk for NSSI conferred by psychological distress.

I also demonstrated that impulsivity was independently predictive of new cases of NSSI even when accounting for positive parenting and distress. As this sample was restricted to participants with no NSSI the year before impulsivity was measured, reverse causation is unlikely. While impulsivity has been previously associated with NSSI, of the four longitudinal studies of self-reported impulsivity reviewed by Hamza and colleagues (2015) longitudinal links between impulsivity and NSSI were only found by Black and Mildred (2013) and they did not control for NSSI or other confounds at Time 1. All four studies were, moreover, based on smaller samples than the present study and may, therefore, have lacked power to detect a longitudinal association. Thus, the present longitudinal findings provide some of the first and most robust support for a causal relationship between impulsivity and new onset of NSSI. I also tested the interaction terms between each of the impulsivity scales and general distress at T1 in predicting onset of NSSI by T2. All interactions were non-significant, indicating that while

impulsivity and distress are both independently predictive of future NSSI, the effect is additive rather than multiplicative. Likewise, positive parenting did not moderate the effects of impulsivity.

While there were small cross-sectional associations between positive parenting and lower impulsivity, neither factor at T1 was prospectively predictive of the other at T2. It is therefore not possible to make any conclusions about directionality in the association between these two variables. This lack of prospective association between positive parenting and impulsivity was unexpected in light of research demonstrating the key role played by positive early child-parent interactions in development of impulse control (Londerville & Main, 1981; Scott et al., 2009). It is possible that impulsivity develops during a critical period in the context of early child-parent relationships and is largely stable and independent of positive parenting by adolescence. Alternatively, impulse deficits may develop from more severe proximal family dysfunction than was measured by the PPQ. The association between parenting quality and impulsivity across the developmental life course warrants further investigation.

The associations between friendship quality and NSSI disappeared when positive parenting was controlled for. Conversely, positive parenting remained significantly predictive of new onset NSSI over friendships, age, and gender, once more demonstrating the predominant influence of child-parent over child-peer relationships in predicting adolescent NSSI.

6.4.1 Clinical implications

Positive parenting, psychological distress, and impulsivity are all potentially useful areas of therapeutic focus in regards to NSSI. Working to encourage positive parenting may be an effective way of reducing both distress and NSSI. While treating psychological distress alone will also likely reduce risk of NSSI, in the context of a continued lack of positive parenting, distress and the associated risk of NSSI may recur. Therefore, in order to effectively reduce the on-going risk of NSSI it may be important that parenting deficiencies are addressed. I have provided evidence that impulsivity may also be a risk factor for future engagement in NSSI, even in the absence of immediate psychological

distress. Therefore, addressing impulsivity (for example through psychological training or anti-impulsivity medication) may be an effective means of lowering the risk of NSSI or even of treating recurrent NSSI among young people. However, the present study's lack of prospective associations between positive parenting and impulsivity may indicate that family focused therapeutic attempts at reducing NSSI will be less effective amongst young people for whom impulsivity is a key factor in their NSSI engagement.

6.4.2 Limitations

This study, although one of the first longitudinal studies examining impulsivity and NSSI in a large non-clinical sample, was limited in that there were only two waves of data collection completed at the time of these analyses. As such, although cross-lagged analyses demonstrated that parenting at T1 was predictive of distress at T2, it is possible that parenting before T1 does not actually predict distress by T1, which is the assumption on which my mediation model was based. The best way to remedy this shortcoming and establish the causal relationships between various antecedents of NSSI would be through a study with three or more waves of data collection.

6.5 Conclusion

This study demonstrated that positive parenting, lower psychological distress, and lower impulsivity predict reduced rates of new onset cases of NSSI over the following year. This is the first study to my knowledge to demonstrate a robust prospective link between impulsivity and NSSI, indicating that improving impulse control may be an effective way of lessening NSSI among adolescents and young adults. Concordant with prior cross-sectional work (Hallab & Covic, 2010), this study demonstrated longitudinally that much of the well-established association between parent-child relationships and NSSI could be accounted for by the association between parenting and psychological distress.

Chapter 7

Self-Harm and Relationship Experiences (SHARE)

Having clarified some of the directions and paths of association between NSSI and several risk factors thereof using longitudinal data sets, I next endeavoured to explore the roles of all of these risk factors together in a multivariate model of NSSI. In pursuit of this goal, I collected data on NSSI, impulsivity, parent and peer attachment, and general distress from 700 adolescents in the Cambridgeshire area as part of the Self-Harm and Relationship Experiences (SHARE) study. Before exploring this multivariate model, however, in this chapter I will present the methodology of this study and brief description of how a measure of general distress was derived, and in the next chapter I will present the validation of a new measure of childhood trauma. Finally, a multilevel path model of the aetiology of NSSI including pathways from impulsivity, distress, trauma, and parent and peer attachment will be presented in Chapter 9.

7.1 Methods

7.1.1 Participants and procedure

Data were collected through The Self-Harm and Relationship Experiences (SHARE) study, a study of Cambridgeshire 6th form students' attachment, NSSI, and psychological wellbeing. SHARE was designed and carried out by myself for the purposes of this thesis. Every school in the Cambridgeshire UK area with 16-18 year old students was contacted by email and telephone and asked if they would be interested in inviting their students to participate in this study. Approval was obtained from the head, or a suitable representative, of all schools from which participants were recruited before any contact was made with students. Moreover, preferences and recommendations from the relevant administrative contact at each school in regards to study advertisement and timing were strictly adhered to. Options for advertisement that were selected by schools included: in-person presentations by myself, assembly announcements, school emails, school website adverts, school tweets, and school newsletters. All advertisements contained a link directing students to an information sheet describing the methods and aims of the study, followed by a consent form, which participants were required to complete if they wished to proceeding further in the survey. Once participants completed the consent form they were emailed a unique link to the rest of the online survey. This study was approved by the Cambridge Psychology Research Ethics Committee, reference Pre.2015.031.

In total, 11 schools agreed to invite their roughly 5000 students to participate in this study. Of these, 596 students provided informed consent and completed the online self-report survey. The sample was predominantly white, with only 76 (13%) participants identifying as non-white. The sample was also predominantly female; 138 (23%) participants identified as male, 445 (75%) as female, 11 (2%) as other, and 2 did not report on gender. Participants' ages ranged from 16-19 (m = 17.24, SD 0.67). A single large sixth form college provided 355 (60%) participants, with the other 10 schools providing between 1 and 51 participants each.

Upon completion of the survey, participants were provided with a debriefing sheet thanking them for their participation, and providing information about the purposes of

this study and how to contact the primary researchers. In addition, participants were provided information about where and how to obtain help if they were distressed by anything they read in the questionnaire, were concerned about any current maltreatment, or were struggling with NSSI or any other emotional or psychological problems. Providing information to participants in this manner left participants more informed of ways to get help than if they had not taken part in the study. A response procedure was also in place for instances where participants' scores on the MFQ, CTEQ, or SHI indicated that they were engaging in dangerous self-harm, were suffering from potentially serious psychological distress, or have been victims of child maltreatment. If participants were deemed at risk for any of the above reasons, I contacted them (first by phone and then by email after several failed attempts by phone) and spoke to them about their current psychological wellbeing, suicidality, and specific histories of trauma. At the conclusion of these interviews, I provided participants with relevant mental health resource information and offered to contact their GPs for them if they wished. All of these risk assessment interviews were reviewed by my supervisor, Dr Paul Wilkinson, who is a clinical child and adolescent psychiatrist and the PI on this project, to determine if further action was needed.

All online content was on project-redcap.org, which is a secure online survey and data management platform currently used by the Cambridge Department of Psychiatry for storing sensitive data. All survey responses were strictly confidential and consent/demographic/contact details were stored independently from the survey package. A unique ID number was used to link the questionnaires and personal information/consent forms.

7.1.2 Measures

Participants provided general demographic information, including: age, gender, school year, postcode, and school. They then completed the following measures.

Trauma: The *Youth Trauma Scale* (YTS) is a 12-item self-report measure of lifetime experiences of trauma. In the present sample exploratory and confirmatory analysis revealed that the YTS comprises two distinct factors: 'person-perpetrated traumas', and

'illness and injury'. A continuous factor score derived from the severity ratings of items on the person-perpetrated factor accounted for the majority of variance in predicting both NSSI and distress, and as such, only this factor will be used in the path model presented in Chapter 9 (for further details of the YTS validation, see Chapter 8).

NSSI: The *Self-Harm Inventory* (SHI) (Sansone et al., 1998) comprises 22 questions regarding respondents' histories of various NSSI behaviours. The SHI uses a broad definition of NSSI and includes items pertaining to eating disorders, substance abuse, sexual promiscuity, recklessness, and psychological self-harm. Its psychometric validity has been established with a group of 423 non-clinical participants, aged 17-30 (Latimer et al., 2009). In SHARE, participants applied the SHI to their lifetime. Participants also answered two dichotomous Yes/No questions adapted from an item on the *Drug, Alcohol and Self-Injury* (DASI) questionnaire: 'Have you *ever* tried to hurt yourself on purpose *without* trying to kill yourself?' and *'In the last month*, have you tried to hurt yourself on purpose *without* trying to kill yourself?' In the present sample, the first item showed adequate convergent validity ($r = 0.66$) with the SHI.

Impulsivity: The UPPS-P Impulsivity Scale (Cyders et al., 2007) is a revised version of UPPS Impulsivity scale, comprising 14 items pertaining to Positive Urgency, in addition to 45 of the items proposed by the developers of the original scale (Whiteside & Lynam, 2001), which measure Negative Urgency, Premeditation, Perseverance, and Sensation Seeking. Positive and Negative Urgency refer to impulsive actions in the context of strong positive and negative emotions respectively. The UPPS-P is widely used (Claes & Muehlenkamp, 2013; Glenn & Klonsky, 2010) and well validated (Cyders et al., 2007; Whiteside & Lynam, 2001).

Attachment: The Inventory of Parent and Peer Attachment (IPPA) (Armsden & Greenberg, 1987) comprises 53 items (28 parents and 25 peer) regarding respondents' relationships with their parents (or people who act as their parents) and close friends, with particular emphasis on the psychological security by which these relationships are characterised. The IPPA yields two overall attachment scores, one for parents and one for peers, each with three subscale scores: degree of mutual trust; quality of communication;

and extent of anger and alienation. High scores on trust and communication subscale represent secure attachment, and high scores on the alienation subscale represent insecure attachment. The scale was developed and validated with participants aged 16 to 20, and has been widely used (Cotterell, 1992; Meeus, Oosterwegel, & Vollebergh, 2002; Papini & Roggman, 1992; M. Smith, Calam, & Bolton, 2009; Ying, Lee, & Tsai, 2007) and well-validated (Armsden & Greenberg, 1987; Lapsley, Rice, & FitzGerald, 1990).

Distress: A multi-instrument composite measure of general distress was derived from a bi-factor analysis of the following instruments.

The *Rosenberg Self-Esteem Scale* (RSE) (Rosenberg, 1965) comprises 10 affirmative statements about a participant's perceptions of their self-worth, yielding a single measure of self-esteem. It was developed with 5,024 high school participants, and is widely used (Scheier, Carver, & Bridges, 1994) and well validated (Hagborg, 1993).

The *Screen for Child Anxiety Related Emotional Disorders* (Birmaher et al., 1997, 1999) comprises 41 statements pertaining to the five *DSM-IV* anxiety disorders: somatic/panic, generalized anxiety disorder, separation anxiety disorder, social phobia, and school phobia. It was developed with a diverse adolescent sample (ages 9-19 years) from a mood and anxiety disorders clinic. It is well validated (Muris, Merckelbach, et al., 1998; Muris, Gadet, Moulaert, & Merckelbach, 1998; Myers & Winters, 2002) and widely used (Hale et al., 2011).

The *Short Form Mood and Feelings Questionnaire* (Angold, Costello, Messer, & Pickles, 1995) comprises 13 statements about participants' experiences of depressive symptoms, derived from the 33-item Mood and Feelings Questionnaire (Costello & Angold, 1988). It is widely used and thoroughly validated with child and adolescent populations (Sharp, Goodyer, & Croudace, 2006; Thapar & Mcguffin, 1998).

The *Affective Reactivity Index* (Stringaris et al., 2012) comprises seven statements pertaining to the participant's general irritability over the previous six months. It was developed and validated with a sample of 218 American children with heterogeneous psychological profiles, as well as 88 psychologically heterogeneous children from the UK

(Stringaris et al., 2012). This instrument was designed for use by either youth or their parents.

7.2 Deriving a measure of General distress

7.2.1 Analysis procedure

Bi-factor analyses on the above distress measures were conducted in keeping with the methods reported in section 4.3. For constructing the confirmatory factor analysis (CFA) model, the criteria used by St Clair et al. (2017) were used. Specifically, a minimum exploratory bi-factor analysis loading of .15 was used to create the specific factors, and .20 for the general factor. Theoretically meaningful modifications with a chi square change above 99 were added individually to the relevant factor. Non-significant CFA loadings were then removed as well as items that loaded below .20 for both general and specific factors. Items with cross loadings on the specific factors were then evaluated. Any cross loadings below .30 were removed individually, unless both were between .20 and .30, in which case both were retained. Cross loadings were also removed if there was a discrepancy between the loadings greater than .30, particularly if the lower cross loading did not theoretically fit with the other indicators on the factor.

For exploratory and confirmatory factor analysis, WLSMV (Weighed Least Square for categorical data mean and variance adjusted) estimator was used. EFA and CFA were performed in MPlus version 7.2. All other analyses were conducted in STATA 14 (StataCorp, 2015).

7.2.2 Results

Table 7.1 shows correlations between the above measures of distress. All of the scores were highly correlated with each other indicating their suitability for factor analysis.

Table 7.1
Pearson correlations between distress measures and sub-scales

	MFQ	1.	2.	3.	4.	5.	6.	7.
1. RSES	-0.79							
2. ARI	0.53	-0.46						
SCARED								
3. Total	0.72	-0.67	0.47					
4. Panic disorder	0.66	-0.58	0.44	0.90				
5. General anxiety	0.62	-0.6	0.39	0.86	0.68			
6. Separation anxiety	0.45	-0.37	0.33	0.71	0.60	0.55		
7. Social anxiety	0.49	-0.51	0.27	0.73	0.48	0.61	0.38	
8. School avoidance	0.63	-0.58	0.43	0.76	0.69	0.56	0.49	0.45

Note: All correlations sig. at $p < .001$

The most parsimonious Bi-EFA model that also met strict criteria for acceptable model fit comprised one general and four specific factors (CFI = .96, TLI = .96, RMSEA = .04, SRMR = 0.04, Chi^2 = 4024.80, df = 2140). EFA factor loadings are displayed in Table 7.2.

All items loaded significantly onto the general factor. The four specific factors comprised items measuring panic disorder and school anxiety (School), anxiety in social situations and with strangers (Social), separation anxiety (Separation), and affective reactivity (Reactivity) respectively.

In CFA, no modifications with a chi square change above 100 were suggested. A number of items loaded below .20 on the specific factors and were removed accordingly. These were: SCARED 2, 20, 23, 28, MFQ 1, 2, 5, 8, 9, 10, 11, 13, RSES 1, 2, 3, 4, 5, 6, 7, 9, 10 from Specific Factor 1 (School); SCARED 4, 20, 33, 35, MFQ 9, 13 from Specific Factor 2 (Social); SCARED 40, MFQ 2, RSES 1, 3, 4, 5, 7, 9, 10 from Specific Factor 3 (Separation); MFQ 4, 7, RSES 8 from Specific Factor 4 (Reactivity). In addition, SACRED 16 and 29 were removed from the Social factor and SCARED 8 was removed from the Separation factor due to higher cross loadings on other specific factors. In the final model, SCARED 16 loaded below .20 (.19) on the General factor and was removed from the entire model accordingly. All remaining factor loadings were above .20 and

significant at $p < .001$. Descriptive statistics for the individual scale scores from each distress measure, as well as for the derived factors, are displayed in Table 7.3.

Table 7.2
Factor loadings from initial bi-EFA

Item summary	Gen.	S. 1	S. 2	S. 3	S. 4
SCARED					
1. When frightened, hard to breathe.	**0.65**	**0.45**	-0.08	0.09	-0.07
2. Headaches at school.	**0.53**	0.15	-0.09	-0.01	0.09
3. Don't like new people.	**0.53**	-0.03	**0.57**	-0.05	0.03
4. Scared sleeping away from home.	**0.50**	0.07	0.15	**0.37**	0.11
5. Worry about people liking me.	**0.55**	-0.13	**0.28**	**0.26**	-0.07
6. Passing out when frightened.	**0.74**	**0.45**	-0.11	0.00	-0.02
7. I am nervous.	**0.74**	**0.17**	**0.33**	0.15	-0.02
8. Follow mother or father.	**0.33**	0.07	**0.37**	0.26	0.04
9. I look nervous.	**0.65**	**0.21**	**0.32**	0.06	0.03
10. Nervous with strangers.	**0.59**	0.03	**0.67**	0.06	-0.02
11. Stomachaches at school.	**0.61**	**0.27**	0.04	-0.03	0.05
12. Feel crazy when frightened.	**0.77**	**0.30**	-0.01	0.00	0.05
13. Worry about sleeping alone.	**0.60**	0.09	0.00	**0.31**	-0.02
14. Not as good as others.	**0.66**	-0.07	0.15	**0.26**	-0.07
15. Feel things are not real.	**0.65**	**0.19**	-0.08	0.08	-0.06
16. Nightmares about parents.	0.35	0.09	-0.17	0.70	0.02
17. I worry about going to school.	**0.77**	**0.21**	0.09	-0.06	-0.06
18. Heart beats fast.	**0.54**	**0.45**	0.04	0.09	-0.05
19. I get shaky.	**0.66**	**0.45**	0.03	-0.01	0.00
20. Nightmares about self.	**0.50**	0.17	-0.15	**0.35**	0.01
21. I worry about things working out.	**0.66**	0.00	0.09	**0.32**	-0.05
22. I sweat when scared.	**0.55**	**0.28**	0.10	0.05	0.08
23. I am a worrier.	**0.71**	0.20	0.12	**0.43**	-0.01
24. Frightened for no reason.	**0.78**	**0.33**	0.04	0.12	0.00
25. Afraid to be home alone.	**0.52**	0.09	-0.04	**0.28**	0.03
26. Hard to talk to strangers.	**0.57**	-0.02	**0.68**	-0.06	0.06
27. Feel choking when scared.	**0.73**	**0.40**	-0.04	-0.05	0.04
28. People say I worry too much.	**0.68**	0.24	0.06	**0.38**	0.00
29. Dislikes being apart from family.	**0.35**	-0.03	0.30	**0.53**	0.13
30. Afraid of anxiety attacks.	**0.75**	**0.32**	-0.07	0.03	-0.02
31. Worry for parents.	**0.34**	0.04	-0.10	**0.67**	0.00
32. Shy with strangers.	**0.45**	-0.03	**0.80**	-0.01	-0.06
33. Worry about the future.	**0.68**	-0.06	0.18	**0.41**	-0.03
34. Nauseous when scared.	**0.74**	**0.31**	-0.14	-0.02	0.03

35. I worry about how well I do things.	**0.65**	0.00	0.19	**0.43**	-0.06
36. Scared to go to school.	**0.82**	**0.22**	0.06	-0.11	-0.08
37. Worry about past events.	**0.72**	0.10	0.09	**0.23**	-0.02
38. Dizzy when scared.	**0.76**	**0.47**	-0.15	0.03	-0.02
39. Nervous in front of audience.	**0.56**	0.04	**0.46**	0.03	-0.07
40. Nervous at social events.	**0.57**	0.05	**0.53**	0.15	-0.07
41. I am shy.	**0.43**	-0.06	**0.71**	-0.07	-0.06
MFQ					
1. I felt miserable or unhappy.	**0.76**	-0.20	-0.06	-0.10	0.10
2. I didn't enjoy anything at all.	**0.73**	-0.19	-0.03	-0.21	0.10
3. I felt very tired.	**0.64**	-0.04	-0.10	-0.09	0.11
4. I was very restless.	**0.62**	0.07	-0.11	-0.08	0.19
5. I felt I was no good anymore.	**0.86**	-0.27	-0.10	-0.01	0.00
6. I cried a lot.	**0.69**	-0.02	-0.13	0.02	0.05
7. Difficulty thinking or concentrating.	**0.70**	-0.02	-0.09	-0.08	0.19
8. I hated myself.	**0.85**	-0.29	-0.08	-0.09	-0.01
9. I was a bad person.	**0.81**	-0.21	-0.16	-0.04	0.11
10. I felt lonely.	**0.73**	-0.24	0.01	0.02	0.04
11. I thought nobody loved me.	**0.79**	-0.29	-0.06	-0.05	0.05
12. Not as good as other kids.	**0.82**	-0.22	0.02	0.09	-0.03
13. I did everything wrong.	**0.85**	-0.22	-0.16	0.00	0.01
ARI					
1. I am easily annoyed by others.	**0.47**	0.01	0.05	0.03	**0.59**
2. I often lose my temper.	**0.45**	0.00	0.00	0.02	**0.81**
3. I stay angry for a long time.	**0.50**	0.01	-0.02	-0.04	**0.55**
4. I am angry most of the time.	**0.58**	-0.04	-0.09	0.03	**0.69**
5. I get angry frequently.	**0.54**	-0.01	-0.08	-0.02	**0.73**
6. I lose my temper easily.	**0.44**	0.00	0.00	-0.01	**0.79**
7. Irritability causes me problems.	**0.59**	-0.04	-0.02	0.01	**0.63**
RSES					
1. I am satisfied with myself.	**-0.79**	0.34	-0.03	0.22	0.02
2. I think I am no good at all.	**-0.78**	0.22	0.05	0.05	0.06
3. I have a number of good qualities.	**-0.68**	0.32	-0.02	0.28	0.00
4. I am as competent as other people.	**-0.65**	0.19	0.01	0.20	-0.04
5. I do not have much to be proud of.	**-0.71**	0.26	-0.01	0.21	0.01
6. I certainly feel useless at times.	**-0.81**	0.20	0.05	0.05	0.06
7. I'm a person of worth.	**-0.71**	0.29	-0.06	0.26	-0.01
8. I want more self-respect.	**-0.64**	0.09	-0.06	0.01	0.16
9. I feel that I am a failure.	**-0.84**	0.26	0.01	0.17	0.02
10. I am positive about myself.	**-0.75**	0.32	-0.08	0.20	-0.01

Gen. General factor
S. Specific factor
Loadings in final CFA models shown in bold

The fit of this final model was poorer than indicated by EFA (CFI = .91, TLI = .98, RMSEA = .07, WRMR = 1.31, Chi^2 = 1000.86, df = 281). The CFI and RMSEA did not meet the original criteria for model fit, however they do meet the criteria used by other researchers: CFI above 0.90 (Bentler, 1990, 1992; Tucker & Lewis, 1973); RSMEA above 0.05 and less than 0.08 (MacCallum et al., 1996). As a bi-factor model of general distress is now widely used and accepted, these more lenient model fit criteria should be sufficient.

Table 7.3
Descriptive statistics for the composite measures and derived factor scores of distress

Item	n	Mean	SD	Sk.	K.	r with NSSI
MFQ	592	1.74	0.57	0.53	2.20	0.63***
RSES	590	2.09	0.57	-0.12	1.89	-0.59***
ARI	591	1.51	0.53	1.18	3.53	0.45***
SCARED						
Total	594	1.76	0.42	0.42	2.41	0.51***
Panic disorder	594	1.62	0.49	0.84	2.78	0.54***
General anxiety	594	2.19	0.55	-0.23	2.02	0.39***
Separation anxiety	594	1.43	0.40	1.11	3.85	0.32***
Social anxiety	395	1.97	0.61	0.12	1.89	0.29***
School avoidance	590	1.57	0.52	0.87	3.00	0.49***
Distress						
General	596	0.01	0.46	0.12	2.64	0.62***
School	596	0.02	0.54	0.23	3.15	0.12*
Social	596	0	0.51	0.10	2.43	-0.07
Separation	596	0	0.44	-0.20	3.09	-0.01
Reactivity	596	0.05	0.47	0.46	3.05	0.06

Sk. Skew
K. Absolute kurtosis
* $p < .05$
*** $p < .001$

The General factor accounted for the majority of variance in the model and was the strongest predictor of NSSI in the present sample (Point bi-serial correlations with new NSSI shown in Table 7.3).

7.3 Conclusion

All but 1 of 71 items from 4 well-validated and widely used measures of psychological distress loaded onto a general distress factor with adequate model fit. This general distress measure was highly correlated ($r = 0.62$) with NSSI and will be used as the only measure of distress in the subsequent two chapters. General discussion about this study and limitations will be expanded upon in section 9.4.1.

Chapter 8

Validation of a New Measure of Childhood Trauma – The Youth Trauma Scale

In this chapter I present a review of existing measures of childhood trauma, followed by a validation of a new and much needed measure of childhood trauma, the Youth Trauma Scale, tested in the Self-Harm and Relationship Experiences (SHARE) study.

Abstract

Background: Traumatic childhood experiences are common and widely impactful, yet there are few measures thereof that are both comprehensive and psychometrically valid. In this paper I present and test the validity of a new measure of childhood trauma, the Youth Trauma Scale (YTS).

Methods: Participants from the SHARE study (see chapter 7 for details) completed the YTS, which was developed from several pre-existing measures of childhood adversity. Participants also completed measures of psychological distress and non-suicidal self-injury.

Results: Exploratory and confirmatory factor analyses showed that the YTS comprises two distinct factors: Perpetrated traumas such as assault and parental discord, and infirmity related events such as illness and injury. Perpetrated traumas account for the majority of variance in predicting distress and NSSI and as such these items may be able to be used alone as a smaller scale. Likewise, the benefit of including severity ratings was small, and so could be omitted when brevity is an important consideration. For maximum information, items from both scales and severity ratings should be included, and sum of severity scores derived.

Conclusion: The YTS appears to be a comprehensive and psychometrically valid measure of early traumatic experiences, redressing a gap in the existing body of available measures.

8.1 A review of traumatic events measures

Given their influence on mental health, the accurate and informative assessment of traumatic experiences is of paramount importance to both clinical practice and research. However, many studies have used measures that have undergone little or no reported psychometric validation (e.g. Åslund et al., 2009; Briere & Runtz, 1990; Taylor et al., 2006). The Adverse Childhood Experiences questionnaire (ACE) (Felitti et al., 1998) for example, although widely used (e.g. Dube et al., 2001, 2003; V. J. Edwards, Holden, Felitti, & Anda, 2003), has undergone limited psychometric investigation and the psychometric details of how it was developed are unreported. Moreover, its items are aimed at repeat forms of trauma as opposed to isolated traumatic incidents. Likewise, some studies (eg. Breslau, Davis, Andreski, & Peterson, 1991; Chorbov et al., 2007; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995) have used items based on the DSM List of Traumatic Events (American Psychiatric Association, 2000), however these items have received scant psychometric attention as a scale. Moreover, the list includes an item about direct combat experience in a war, which is unlikely to be endorsed by many adolescents in developed western nations.

Many other measures of traumatic experiences are also largely inappropriate for adolescents and young people, containing items about things such as marital discord and workplace problems, for example the List of Threatening Events (Brugha, Bebbington, Tennanp, & Hurry, 1985), the Social Problems Questionnaire (Corney, 1988), or the Interview for Recent Life Events (Jacobs et al., 2006). Other measures, more appropriate for youth populations, only assess one specific form of trauma, such as: sexual abuse e.g. the Childhood Un-wanted Sexual Events (Lange, Kooiman, Huberts, & Oostendorp, 1995), the Sexual Abuse Exposure Questionnaire (Rodriguez, Ryan, Rowan, & Foy, 1996), the Sexual Events Questionnaire (Calam & Slade, 1989), the Sexual Experience Questionnaire (Wagner & Linehan, 1994), and the Sexual Life Events Inventory (Palmer, Chaloner, & Oppenheimer, 1992); physical abuse e.g. the Childhood Violence Scale (Riggs, O'Leary, & Breslin, 1990), the Parental Physical Maltreatment Scale (Briere & Runtz, 1990; Leserman, Drossman, & Li, 1995); or verbal abuse e.g. the Parental Psychological Maltreatment Scale (Briere & Runtz, 1990).

There are a number of validated clinician-administered measures of childhood trauma, such as the Childhood Trauma Interview (CTI) (Bernstein et al., 1994). For review see (C. A. Roy & Perry, 2004). However, these are often lengthy and necessarily require a trained clinician, making them expensive, time consuming, and generally impractical for epidemiological and even some clinical practice (Bremner, Bolus, & Mayer, 2007).

A review of measures of childhood trauma developed between 1985 and 2003 identified 21 self-report instruments; only three assessed multiple types of trauma and reported on psychometric properties (C. A. Roy & Perry, 2004), and all have limitations. These latter three instruments were the Assessing Environments III (AEnvIII) (Berger et al., 1988), the Childhood Abuse and Trauma Scale (CATS) (Sanders & Becker-Lausen, 1995), and the Childhood Trauma Questionnaire (CTQ) (Bernstein et al., 1994). The AEnvIII comprises 164 'Yes/No' items across 15 different scales, however many of its items do not focus on trauma. The CTQ, and the Childhood Trauma Questionnaire short form (CTQ-SF) (Bernstein et al., 2003) seem to conflate trauma and family dysfunction. The CTQ-SF subscales 'Physical neglect", 'Emotional neglect', and 'Emotional abuse' all appear to be more closely related to family functioning and child-parent relationships than trauma, and the measure does not include items about extra-familial traumatic events such as traumatic injury, illness, or violent crime. The same is true of the CATS, which assesses childhood physical, sexual, and emotional abuse but only within the home environment. Furthermore, the AEnvIII, the CATS, the CTQ, and the CTQ-SF do not assess severity of traumatic events. The question of whether traumatic events are best assessed by dichotomous '*Yes/No*' items or along continuous scales of severity has been previously investigated but not definitively answered (Bernstein et al., 2003; Lipschitz, Bernstein, Winegar, & Southwick, 1999).

One further measure, the Early Trauma Inventory– Self Report (ETI-SR) (Bremner et al., 2007), developed after the abovementioned review, appears to be one of the best and most well validated measures of childhood trauma. It comprises 27 items about physical, emotional, and sexual abuse, as well as general traumas. Its items are based on a well-validated 56-item semistructured interview (Bremner, Vermetten, & Mazure, 2000) and were selected through psychometrically supported dimension reduction techniques.

Nevertheless, a number of its items assess specific forms of trauma, particularly specific types of sexual and physical abuse, that could be further reduced or grouped together. Given the strong potential of social desirability to bias responses toward under-report stigmatized traumatic events such as sexual and family traumas (Hardt & Rutter, 2004), I believe it is important that items are phrased in broad and non-stigmatized terms as much as possible, in keeping with Sanders & Becker-Lausen (1995). Additionally, I argue that specificity is not helpful as any list of traumatic experiences cannot be exhaustive, and only biases scores towards those who have experienced the specific items listed. Thus, some measures such as the ETI-SR, the AEnvIII, and the ACE may be suboptimal due to the specificity of their items (e.g. Have you ever been hit with a wire hanger?).

8.2 Basis for a new measure of childhood trauma

There is increasing evidence that different types of traumatic experiences often co-occur and are cumulatively negatively impactful on wellbeing (Dube et al., 2001, 2002; Felitti et al., 1998). Psychological distress may result not from a single acute traumatic event but an accumulation of multiple experiences, as evidenced by the strong graded link between number of childhood traumatic experiences and probability of subsequent suicide attempt, substance abuse, and depressive disorders (Dube et al., 2001, 2003). Thus, sum scores of number of traumatic events experienced is a widely used and theoretically justifiable approach (eg. Bremner et al., 2007; Surtees et al., 2003, 2006).

A basic issue with simple sum scores, however, is that not all traumatic experiences are equal. Some types of traumatic experiences are particularly associated with specific outcomes, such as the relationship of family trauma with subsequent non-suicidal self-injury (Gratz et al., 2002), or the relationship of sexual abuse with subsequent eating disorders (Smolak & Murnen, 2002). Likewise, certain types of trauma seem to be associated with poorer overall prognosis; in a study of bereavement**,** motor vehicle accident**,** and sexual abuse, bereavement was associated with most positive outcomes and sexual abuse was associated with the highest levels of posttraumatic stress disorder (PTSD) (Shakespeare-Finch & Armstrong, 2010). In a German nonclinical sample,

sexual assault showed the strongest association with PTSD, over and above physical assault, serious accidents, and witnessing a trauma (Hapke, Schumann, Rumpf, John, & Meyer, 2006). A Swedish study comparing survivors of physical assault, sexual assault, robbery, sudden unexpected bereavement, war exposure, and motor vehicle accidents demonstrated similar results (Frans, Rimmo, Aberg, & Fredrikson, 2005). In this latter study both physical and sexual assault survivors demonstrated higher levels of PTSD risk than other groups, and motor vehicle accident survivors had the lowest risk of PTSD (Frans et al., 2005).

Frans and colleagues (Frans et al., 2005) suggest that differences in perceptions of trauma intensity could be the main reason for the differential prognoses of certain kinds of trauma. This hypothesis, however, has not yet been tested so far as I know. Moreover, for different people the same kind of trauma may be differently distressing and impactful. As such, it may be important to ascertain not only if an event occurred, but also how traumatic the experience was for the individual involved. By doing so we can also begin to answer questions about whether the level of trauma experienced or the number of different traumas is most important in predicting the impact of trauma. While some events are more acutely traumatic than others and some are more psychologically impactful, these may not be the same. For example, it is possible that a mildly traumatic violent event is more psychologically deleterious than an extremely traumatic accident. Likewise, it is possible that one extremely traumatic event is worse than a number of mildly traumatic events, or vice versa.

There is, moreover, increasing evidence that traumatic experiences may cluster together systematically such that simple absolute quantity may not represent the most accurate or informative way to conceptualize trauma (Appleyard, Egeland, Dulmen, & Sroufe, 2005; Copeland, Shanahan, Costello, & Angold, 2009; Dunn et al., 2011). Traumatic experiences may cluster on the basis of experience types, in which case factor analyses may be an appropriate method of trauma computation. Alternatively, people may cluster into distinct groups on the basis of patterns of traumatic experiences, in which case latent class analyses (LCA) may be an appropriate method of trauma computation. Several studies have successfully employed LCA of adversity and trauma, yielding meaningful

classes differentially predictive of psychopathology (Copeland et al., 2009; Dunn et al., 2011; McLaughlin et al., 2010; Menard, Bandeen-Roche, & Chilcoat, 2004; Shanahan, Copeland, Jane Costello, & Angold, 2008). In the present study, I intend to investigate and compare both LCA and factor analyses to simple dichotomous and sum scores of number of traumatic events and trauma severity in order to determine which is the most prognositically informative way of calculating trauma.

The purpose of the present study is to develop a new measure of childhood trauma, the Youth Trauma Scale (YTS), which is advantageous over existing measures in that it assesses not only occurrence but also severity of multiple types of trauma, and comprises non-copyrighted items derived from psychometrically supported dimension reduction techniques. I shall also identify the most prognostically meaningful methods of establishing 'total trauma' scores by comparing the associations of different trauma scores with non-suicidal self-injury and psychological distress. This will include comparing trauma sum scores, factor scores, and latent classes, and comparing severity scores versus dichotomous scores for presence of each trauma type.

8.3 Methods

For further details of SHARE participants, procedures, and measures, see Section 7.1.

8.3.1 Trauma measure

Trauma: The *Youth Trauma Scale* (YTS) was developed from several pre-existing measures of childhood adversity. The primary measure on which the YTS was based is the Childhood Traumatic Events Scale (CTE) (Pennebaker & Susman, 1988), which comprises seven questions about whether a traumatic event occurred in the participant's lifetime, and if so, when it occurred, and how traumatic it was from *'1 Not at all Traumatic'* to *'7 Extremely Traumatic'*. The items from the CTE (all of which were included in the YTS) assessed: death of a very close friend or family member, major upheaval between parents, traumatic sexual experience, victim of violence, extreme illness or injury, and any other major traumatic event. The CTE has been shown to be

reliable and valid (Pennebaker, 1993), and has been used in empirical research (Noyes et al., 2002). The format and questions from the CTE were included in the YTS, apart from the section about when each traumatic event occurred, which was omitted. In addition to these questions, three items were taken from a set of questions assessing childhood adversity (Surtees et al., 2003). These items were: separation from mother for more than 1 year; parental unemployment for more than 1 year when they wanted to be working; family member's alcohol or drug use sufficient to cause family problems. Further, one question pertaining to parental mental illness and depression was taken from the Adverse Childhood Experience study (Felitti et al., 1998), and two questions were added pertaining to witnessing family members' experiences of violence and serious injury or illness, taken from the List of Threatening Experiences (Brugha et al., 1985). Other items from these latter three measures were not added to the YTS because they were either irrelevant to adolescents or were redundant with items that had already been added. See table 8.1 for final YTS items. Finally, an item was added asking whether any experiences of violence or sexual abuse that had been reported in the survey had been previously reported to an authority. This item was included in order to facilitate the response procedure for instances of suspected child abuse.

8.4 Analysis procedure

The aim of my analyses was to explore the validity of my proposed measure of traumatic experiences, the YTS, and to determine the most informative way to conceptualize and calculate trauma therefrom. As the YTS is a new measure, analyses were conducted with a bottom-up theory-free approach in order to determine the underlying structure and validity of the measure as indicated by the data. Moreover, multiple approaches at item reduction were conducted in parallel and compared in order to determine the most informative way to employ the YTS and to conceptualise trauma in general.

Responses to each YTS item were examined for skew, kurtosis, response variability, and inter-item correlations. Factor analysis, bi-factor analysis, and latent class analysis were conducted on the dichotomous yes/no items, on the ordinal trauma severity items (1-7)

with no trauma recoded as 0 instead of missing, and on the items dichotomised on the basis of a trauma severity score equivalent or greater than 4 (moderately traumatic) such that events scored less than four were counted as 0 or 'No'. Details of these analyses are reported below. Analyses were conducted both with and without the open ended Item 12 as the extent to which this heterogeneous item would fit with the rest of the scale was unclear.

Exploratory factor analyses (EFA) and confirmatory factor analyses (CFA) were each performed on the whole sample, as sample size limited my ability to split the sample randomly into an exploratory and confirmatory sample. The WLSMV (weighed least square for categorical data mean and variance adjusted) estimator was used for EFA and CFA. Parallel analyses (PA) were conducted using fa.parallel from the psych package for R (Revelle, 2011). EFA, CFA, bi-factor, and latent class analyses (LCA) were performed in MPlus version 7.2 (Muthén & Muthén, 2012). Descriptive statistics, discriminant validity, and all other analyses were conducted in STATA 14 (StataCorp, 2015).

8.4.1 Factor analysis

The methods used for factor analyses were the same as those reported in Sections 4.4.1 and 4.4.2, except that PA/EFA and CFA were conducted on the whole sample, due to insufficient sample size for split-half analysis.

8.4.2 Bi-factor analysis

Given the tendency of some traumatic events to cluster together (Appleyard et al., 2005; Copeland et al., 2009; Dunn et al., 2011), bi-factor analyses were performed in order to determine if a general-specific model of trauma would show superior fit and validity to the EFA/CFA models. The methods used for these analyses were the same as those reported in Section 4.4.3.

8.4.3 Latent class analysis

LCA (Muthén & Muthén, 2000) is a person-based dimension reduction technique that clusters individuals on the basis of their patterns of traumatic experiences. It differs from

EFA, which is a variable-based dimension reduction technique that clusters traumatic experiences into factors on each of which every individual has a score. As these analyses were exploratory, the bootstrapped parametric likelihood ratio test was used to determine the most parsimonious model with acceptable fit. The theoretical interpretability of the indicated model was judged by examining the probability of endorsing each traumatic experience within each class. Model parameters were estimated using maximum likelihood.

8.4.4 Total scores

Given that sum-based scores are more likely to be used by future researchers than factor scores (they are simpler to generate, and do not require a large sample size, for example), additional total scores were calculated for: total number of traumatic event types experienced; number of traumatic events experienced with a severity score equivalent or greater than 4 versus less than 4; total of reported trauma severity across all traumatic events experienced; mean reported trauma severity across all traumatic events experienced; highest reported trauma severity across all traumatic events; a dichotomous score of whether any traumatic event had been experienced; and a dichotomous score of whether any traumatic event had been experienced with a severity score equivalent or greater than 4.

8.4.5 Gender and age

For simplicity and due to insufficient sample size of participants identifying their gender as 'other', analyses on gender differences contrast participants that identified as either male or female. Gender and age (in months) effects on the derived YTS scores were calculated with correlations (tetrachoric for binary YTS and gender; point bi-serial for continuous YTS and gender, and binary YTS and age; Pearson for continuous YTS and age). Gender-age interactions were tested with interaction terms in separate regressions for each TYS score (logistic for binary YTS scores, linear for continuous YTS scores). In subsequent analyses, gender was controlled for as an unordered three-level (male, female, other) categorical covariate.

8.4.6 Prognostic associations

To determine which method of calculating distress is the most meaningful and informative, partial correlations between each of the YTS scores and self-reported NSSI and psychological distress were calculated (tetrachoric for binary YTS and NSSI; point bi-serial for continuous YTS and NSSI, and binary YTS and distress; Pearson for continuous YTS and distress), controlling for gender and age. In order to limit the potential of reverse causality, NSSI analyses contrasted participants who reported engaging in NSSI within the past month (n = 97) against those who had never engaged in NSSI (n = 325). The unique variance of theoretically related variables (paired factor scores, number and severity scores), in predicting distress and NSSI was tested with linear and logistic regressions respectively. Gender and age interactions with YTS scores were tested with separate linear and logistic regressions for distress and NSSI respectively.

8.5 Results

Frequencies of dichotomous yes/no YTS items and descriptive statistics of their respective trauma severity scores are shown in Table 8.1. Overall, the most traumatic event was the 'Other' category. The most traumatic specific event was seeing a parent or sibling being the victim of violence, followed by being the victim of violence. The least traumatic event was having an unemployed parent. The most commonly reported traumatic event was a death of a very close friend or family member, followed by parental mental illness and a major upheaval between parents. The least commonly endorsed items were maternal separation, and being the victim of violence.

Table 8.1
Frequency and descriptive statistics for the YTS items and derived scores

	Yes/No	Trauma severity (1-7, if event endorsed)			
Individual YTS items	**n 'yes' (%)**	**Mean**	**SD**	**Sk**	**K.**
1. A death of a very close friend or family member?	279 (46)	4.50	1.57	-0.33	2.43
2. A major upheaval between your parents (such as divorce, separation)?	167 (28)	4.50	1.57	-0.52	2.49
3. A traumatic sexual experience (raped, molested, etc.)?	71 (12)	4.47	1.60	-0.15	1.86
4. Were you the victim of violence (child abuse, mugged or assaulted -- other than sexual)?	52 (9)	4.80	1.70	-0.47	3.04
5. Did you ever see a parent or sibling being the victim of violence?	70 (12)	4.88	1.50	-0.31	2.20
6. Were you extremely ill or injured?	74 (12)	4.56	1.75	-0.38	2.03
7. Was a parent or sibling seriously ill or injured?	125 (21)	4.33	1.83	-0.46	2.83
8. Did a parent suffer from mental illness or depression?	176 (29)	4.62	1.46	-0.03	2.23
9. Were you separated from your mother for more than 1 year?	34 (6)	4.05	1.69	0.51	2.04
10. Was either of your parents unemployed for more than 1 year when they wanted to be working?	102 (17)	3.29	1.55	0.45	2.47
11. Was parental or sibling alcohol or drug use severe enough to cause family problems?	75 (12)	4.53	1.71	-0.34	2.16
12. Did you experience any other major upheaval that you think may have shaped your life or personality significantly?	135 (22)	5.17	1.45	-0.42	2.43

Sk. Skew
K. Kurtosis
Perfect normal distribution: skewness = 0 and kurtosis = 3

8.5.1 Exploratory factor analyses

Analyses on the dichotomous '*Yes/No*' items, the dichotomous trauma severity scores above or equal to/below 4, and the trauma severity items (0-7) yielded similar results. In all cases, the open-ended item 12 loaded significantly and above the threshold on at least one factor in both EFA and CFA, and models with the item had superior fit and stronger correlations with distress and NSSI than those without item 12. Conversely, in all cases, item 1 (death of close friend or family member) loaded below the threshold on all factors in either EFA or CFA, and models without item 1 had superior fit and stronger correlations with distress and NSSI than those with item 1. EFA were rerun without Item 1. In the interest of brevity, only analyses with Item 12 and without Item 1 are reported in greater detail below. PA on all three ways of scoring the YTS items (*Yes/No, </> 4 severity, severity 0-7*) indicated that a 2-factor model should be examined. EFA factor loadings for these analyses are shown in Table 8.2.

Table 8.2
EFA factor loadings for YTS items

	Yes/No		**Severity </> 4**		**Severity**	
Item summary	**F 1**	**F 2**	**F1**	**F2**	**F1**	**F2**
2. Parental upheaval	**0.50**	0.05	**0.40**	0.20	**0.40**	0.16
3. Sexual trauma	**0.69**	-0.17	**0.65**	-0.20	**0.54**	-0.10
4. Violence to self	**0.78**	0.02	**0.88**	0	**0.85**	0
5. Violence to family	**0.86**	-0.08	**0.72**	0.13	**0.83**	-0.01
6. Illness or injury (self)	-0.19	**0.49**	0.19	**0.19**	-0.05	**0.31**
7. Family illness or injury	-0.08	**0.41**	-0.18	**0.61**	-0.01	**0.42**
8. Parental mental illness	**0.46**	0.31	0.08	**0.70**	0.30	**0.52**
9. Maternal separation	**0.55**	0.01	**0.49**	0.22	**0.45**	0.12
10. Parental unemployment	0.16	**0.67**	0.02	**0.69**	0.13	**0.63**
11. Family substance abuse	**0.54**	0.12	**0.38**	0.34	**0.44**	0.28
12. Other	0.01	**0.58**	-0.05	**0.55**	-0.01	**0.63**

Factor on which item loaded in in final CFA models shown in bold

For EFA of the dichotomous '*Yes/No*' items, the 2-factor model had adequate fit (CFI = .95, TLI = .95, RMSEA = .04, SRMR = 0.08, Chi^2 = 60.46, df = 34) and was readily interpretable. The model was tested with CFA. Item 8 was dropped from Factor 2 as it

loaded below .30 on this factor and above .30 on Factor 1. This final model had good model fit (CFI = .98, TLI = .98, RMSEA = .02, WRMR = 0.80, Chi^2 = 42.15, df = 33).

For EFA of the items dichotomised on the basis of a trauma severity score equivalent and greater than 4 (somewhat traumatic) or less than 4, the 2-factor model had adequate fit (CFI = .99, TLI = .99, RMSEA = .01, SRMR = 0.07, Chi^2 = 27.73, df = 25) and was similar to the model indicated for the *'Yes/No'* dichotomised items reported above. Item 6 had low loadings (.19) on both factors, however it was retained for CFA to keep the model similar to the yes/no dichotomous analyses reported above. All three ways of calculating YTS scores (*yes/no, severity </> 4, severity 0-7*) were also tested without item 6 and in general showed weaker prognostic associations with NSSI and distress so will not be reported on further. In CFA item 6 was removed from Factor 1 as it loaded higher on Factor 2, and item 11 was removed from Factor 2 because it loaded non-significantly on this factor and was significant and higher on Factor 1. This final model had good model fit (CFI = .99, TLI = .99, RMSEA = .01, WRMR = 0.74, Chi^2 = 32.23, df = 29).

For EFA of the ordinal trauma severity items, the 2-factor model had adequate fit (CFI = .98, TLI = .97, RMSEA = .03, SRMR = 0.06, Chi^2 = 39.95, df = 24) and was similar to the models for the other two methods of calculating YTS scores reported above. No modifications were suggested by CFA and this model had good model fit (CFI = .98, TLI = .98, RMSEA = .03, WRMR = 0.60, Chi^2 = 43.21, df = 29).

For all three sets of analyses, Factor 1 appeared to comprise items regarding person-perpetrated traumas such as violence, substance abuse, and family discord, and Factor 2 comprised items about traumatic events not so directly caused by people's decisions, such as illness and injury. Henceforth, these factors will be referred to as 'Perpetrated' and 'Infirmity', respectively.

8.5.2 Bi-factor analyses

For all three ways of calculating YTS scores (*yes/no, severity </> 4, severity 0-7*), bi-factor models would not converge in CFA, indicating that a general-specific model did not suit these data. These analyses will not be reported on further.

8.5.3 Latent class analyses

As with EFA and CFA, LCA models without item 1 and with item 12 performed best and are reported below.

For the '*Yes/No*' dichotomous items, the bootstrapped parametric likelihood ratio test indicated that a four-class model was superior to models with fewer classes (H0 LL: -2611.54, $p < .001$). This model had adequate model fit: Log likelihood (LL): -2594.21; Bayesian Information Criteria (LL) = 5489.23; Akaike Information Criteria (LL) = 5282.42; Number of Free Parameters = 47; Chi-square = 1632.66, df = 1995, $p = 1.00$. Probabilities of each '*Yes/No*' YTS item being positively endorsed by members of each of the four classes are shown in Table 8.3. Members of the largest class were unlikely to have experienced any trauma (class name: low trauma). Members of the second largest class were more likely to have experienced nonviolent family traumas (items 2, 7, 8 10, 11, 12) (class name: family trauma). Members of third largest class 2 were more likely to have experienced traumas related to illness and injury (items 6, 7, 8, 10, 12) (class name: illness and injury). Members of the smallest class were more likely to have experienced all kinds of trauma, in particular violent trauma (items 4 & 5) and parental upheaval (item 2) (class name: high trauma).

For the items dichotomised on the basis of a trauma severity score equivalent and greater than 4 (somewhat traumatic) or less than 4, the bootstrapped parametric likelihood ratio test indicated that a 3-class model was superior to models with fewer classes (H0 LL: -2085.70, $p < .001$). This model had adequate model fit: Log likelihood (LL): -2066.40; Bayesian Information Criteria (LL) = 4356.46; Akaike Information Criteria (LL) = 4202.80; Number of Free Parameters = 35; Chi-square = 1051.25, df = 2002, $p = 1.00$. As with the '*Yes/No'* LCA, members of the largest class were unlikely to have experienced

any trauma (class name: low trauma), members of next largest class were more likely to have experienced parental and family related trauma (items 2, 7, 8 10, 11, 12) (class name: family trauma), and members of smallest class were more likely to have experienced all types of trauma, violent trauma in particular (items 4 & 5) (class name: high trauma).

LCA on the ordinal trauma severity (0-7) items indicated models with too many classes (> 6) to be readily interpretable or useful, and will not, therefore be reported on further.

Descriptive and frequency statistics for distress, lifetime NSSI engagement, gender, and age are displayed for each LCA class in Table 8.4.

Table 8.3
Probability of positive responses to YTS items for members of each LCA class

	Yes/No Classes				Severity </> 4 Classes		
Item summary	**C1**	**C2**	**C3**	**C4**	**C1**	**C2**	**C3**
2. Parental upheaval	0.14	**0.50**	**0.63**	0.20	0.14	**0.38**	**0.60**
3. Sexual trauma	0.05	0.18	**0.40**	0.09	0.06	0.07	**0.40**
4. Violence	0	0	**0.79**	0.10	0.01	0.11	**0.66**
5. Family violence	0.01	0.19	**0.67**	0.04	0.02	0.16	**0.65**
6. Illness or injury	0.13	0	**0.22**	**0.57**	0.06	0.10	**0.24**
7. Family illness or injury	0.06	**0.27**	**0.27**	**0.31**	0.12	**0.49**	**0.21**
8. Parental mental illness	0.01	**0.63**	**0.69**	**0.30**	0.09	**0.72**	**0.45**
9. Maternal separation	0.01	0.11	**0.23**	0.03	0.01	0.06	0.17
10. Parental unemployment	0.01	**0.29**	**0.49**	**0.30**	0.02	**0.32**	**0.21**
11. Family substance abuse	0.02	**0.27**	**0.45**	0.05	0.04	**0.23**	**0.44**
12. Other	0.07	**0.37**	**0.44**	**0.35**	0.12	**0.63**	**0.28**

C1 Low trauma
C2 Family trauma
C3 High trauma
C4 Illness and injury
Items in bold to show probabilities > .2

8.5.4 YTS score correlations

Many of the scores derived from different methods of scoring the YTS were highly correlated, as shown in Table 8.5.

Table 8.4
Descriptive and frequency statistics for distress, lifetime NSSI engagement, gender, and age for LCA classes

Class	n (%)	Distress m (SD)	NSSI ever n (%)	Male n (%)	Age m (SD)
Yes/No					
Low trauma	322 (54)	-0.13 (0.44)	115 (36)	78 (24)	17.13 (0.61)
Family trauma	153 (26)	0.17 (0.41)	92 (61)	25 (17)	17.30 (0.74)
High trauma	44 (7)	0.32 (0.42)	34 (77)	8 (18)	17.45 (0.65)
Illness and injury	77 (13)	0.08 (0.47)	40 (52)	27 (35)	17.35 (0.75)
</> 4 severity					
Low trauma	496 (83)	-0.05 (0.45)	209 (42)	124 (25)	17.16 (1.03)
Family trauma	60 (10)	0.27 (0.41)	40 (67)	7 (12)	17.35 (0.67)
High trauma	40 (7)	0.32 (0.36)	32 (80)	7 (18)	17.43 (0.62)

Percentages shown are percentages of valid responses

Table 8.5
Pearson correlations between continuous computed YTS scores

	1	2	3	4	5	6	7	8	9	10
Yes/No factors										
1. Perpetrated										
2. Infirmity	0.86									
Severity </> 4 factors										
3. Perpetrated	0.88	0.73								
4. Infirmity	0.80	0.79	0.86							
Severity factors (0-7)										
5. Perpetrated	0.96	0.80	0.92	0.84						
6. Infirmity	0.86	0.95	0.78	0.89	0.84					
Total scores										
7. Number of events	0.94	0.91	0.85	0.83	0.90	0.91				
8. Number of events > 4	0.83	0.78	0.93	0.91	0.84	0.85	0.90			
9. Sum severity	0.88	0.83	0.90	0.88	0.89	0.89	0.95	0.97		
10. Mean severity	0.62	0.61	0.70	0.70	0.66	0.68	0.62	0.69	0.68	
11. Max severity	0.73	0.73	0.76	0.76	0.75	0.78	0.74	0.74	0.76	0.96

All correlations significant at $p < .001$

8.5.5 Age and gender differences on YTS scores

Correlations between YTS scores and participants' ages and genders are shown in Table 8.6. There were no significant age-gender interactions predicting any of the YTS scores.

Table 8.6
Correlations of YTS scores with age and gender

	Gender	Age
Yes/No factors		
Perpetrated	0.10*	0.16***
Infirmity	0.07	0.13**
Severity </> 4 factors		
Perpetrated	0.12**	0.16***
Infirmity	0.13**	0.13**
Severity factors (0-7)		
Perpetrated	0.11**	0.17***
Infirmity	0.10*	0.13**
Yes/No LCA		
Low trauma	-0.05	-0.15***
Family trauma	0.08*	0.06
High trauma	0.08	0.09*
Illness and injury	-0.09*	0.07
Severity </> LCA		
Low trauma	-0.09*	-0.10*
Family trauma	0.07	0.06
High trauma	0.05	-0.08
Total scores		
Number of events	0.09*	0.17***
Number of events > 4	0.13**	0.16***
Any event	0.11**	0.11*
Any event > 4	0.14**	0.10*
Sum severity	0.12**	0.17***
Mean severity	0.16**	0.12**
Max severity	0.15***	0.13**

* $p < .05$
** $p < .01$
*** $p < .001$
Positive correlations with gender indicate higher scores among girls

8.5.6 Prognostic associations of YTS scores with NSSI and distress

Table 8.7 shows correlations between individual YTS scores and distress and NSSI, controlling for gender and age.

Table 8.7
Correlations between individual YTS items and distress and NSSI, controlling for gender and age.

	Distress			NSSI		
	Yes/No[a]	**</> 4**[a]	**Severity**[b]	**Yes/No**[c]	**</> 4**[c]	**Severity**[a]
1. Death	-0.02	-0.04	-0.02	-0.10	-0.08	-0.07
2. Parental upheaval	0.18***	0.21***	0.20***	0.18**	0.18**	0.18**
3. Sexual trauma	0.20***	0.15**	0.17***	0.28***	0.22***	0.25***
4. Violence	0.20***	0.20***	0.20***	0.19**	0.17**	0.17**
5. Family violence	0.18***	0.18***	0.19***	0.19***	0.15**	0.18**
6. Illness or injury	0.08	0.13**	0.11*	0.06	0.11*	0.08
7. Family illness or injury	0.05	0.06	0.07	0.06	0.06	0.07
8. Parental mental illness	0.21***	0.22***	0.21***	0.20***	0.20***	0.22***
9. Maternal separation	0.08	0.09*	0.09*	0.12*	0.15**	0.14**
10. Parental unemployment	0.20***	0.19***	0.22***	0.17**	0.18**	0.20***
11. Family substance abuse	0.15**	0.13**	0.14**	0.15**	0.18**	0.15**
12. Other	0.17***	0.16***	0.19***	0.13*	0.13*	0.17**

* $p < .05$
** $p < .01$
*** $p < .001$
a. Point-biserial correlations
b. Pearson correlations
c. Tetrachoric correlations

To determine which of the computed YTS scores showed the strongest prognostic associations, correlations (Pearson, tetrachoric, and point-biserial) were calculated between the computed YTS scores and NSSI and distress (shown in Table 8.8). Specifically, Pearson correlations are shown for the associations between distress and EFA factors, LCA individual class probabilities and classes, total number of events, number of events with a severity score equivalent or greater than 4, total of reported trauma severity across all events experienced, mean reported trauma severity across all events experienced, and highest reported trauma severity across all traumatic events.

Point-biserial correlations are shown for the associations between NSSI and the aforementioned continuous and ordinal YTS scores, and for the associations between distress and the dichotomous scores of whether any traumatic event had been experienced and whether any traumatic event with a severity score equivalent or greater than 4 had been experienced. Tetrachoric correlations are shown for the associations between NSSI and the aforementioned dichotomous YTS scores.

Total scores were calculated both with and without item 1, which was dropped from EFA/CFA and LCA models. In all instances, the total scores without Item 1 showed higher Cronbach's alphas and stronger associations with NSSI and distress, and as such only these are reported throughout. As the factor scores demonstrated the strongest associations with NSSI and Distress, separate total scores were computed for each factor based on the model indicated for Yes/No coded items. Associations between these scores and NSSI and distress are also shown in Table 8.8.

The Perpetrated factor showed higher internal consistency than the Infirmity factor as measured by Cronbach's alpha for both sets of factor analysis: for yes/no factors Perpetrated = 0.61, Infirmity = 0.38; for severity factors Perpetrated = 0.59, Infirmity = 0.35. Total scores showed the highest internal consistency: yes/no total score = 0.63, severity total score = 0.67.

There were no significant age or gender interactions between any of the YTS scores predicting distress or NSSI (all $p > .10$).

8.5.7 Regressions

In order to answer the question of whether number of events or severity of events was more uniquely prognostic, and likewise whether Perpetrated or Infirmity events were more uniquely prognostic, the following variable pairs were entered together in separate logistic and linear regressions predicting NSSI and distress respectively, controlling for gender and age: number and mean severity of events; number and maximum severity of events; and severity Perpetrated and Infirmity factors. Only the factor scores from analyses on the severity items are presented as they had demonstrated higher correlations

with NSSI and distress than Yes/No factor scores. Table 8.9 shows results of these regression analyses. All VIFs (Variance Inflation Factors) are less than 10, indicating multicollinearity is not a significant problem in the models.

Table 8.8
Descriptive statistics of YTS scores, and prognostic associations between YTS scores and distress and NSSI, controlling for gender and age

	Correlations		Descriptive statistics			
	Distress	**NSSI**	**Mean**	**SD**	**Skew**	**Kurt.**
Yes/No factors						
Perpetrated	.36***	.35***	0.05	0.38	0.76	2.83
Infirmity	.33***	.30***	0.03	0.18	0.78	2.62
Severity </> 4 factors						
Perpetrated	.36***	.35***	0.07	0.37	1.14	3.71
Infirmity	.35***	.32***	0.04	0.23	0.96	3.12
Severity factors (0-7)						
Perpetrated	.37***	.36***	0.05	0.37	0.91	3.19
Infirmity	.35***	.33***	0.02	0.18	0.88	3.13
Yes/No LCA						
Low trauma	-.32***	-.26***				
Family trauma	.21***	.18***				
High trauma	.19***	.21***				
Illness and injury	.06	.01				
Severity </> 4 LCA						
Low trauma	-.28***	-.28***				
Family trauma	.19***	.19***				
High trauma	.18***	.18***				
Total scores						
Any event	.30***	.27***				
Any event > 4	.29***	.25***				
Number of events	.32***	.32***	1.77	1.83	1.22	4.41
Number of events > 4	.33***	.32***	1.26	1.57	1.71	6.47
Sum severity	.33***	.33***	7.79	9.12	1.73	6.57
Mean severity	.33***	.30***	2.96	2.27	-0.15	1.61
Max severity	.35***	.31***	3.51	2.64	-0.24	1.52

Total scores by factor						
Perpetrated						
Any event	.30***	.29***				
Number of events	.31***	.33***	1.07	1.35	1.45	4.89
Sum severity	.31***	.32***	4.67	6.70	2.00	7.62
Mean severity	.33***	.33***	2.29	2.33	0.26	1.44
Max severity	.33***	.32***	2.57	2.67	0.35	1.50
Infirmity						
Any event	.19***	.15**				
Number of events	.20***	.16**	0.72	0.91	1.15	3.60
Sum severity	.23***	.19***	3.16	4.37	1.60	5.56
Mean severity	.23***	.18**	2.07	2.41	0.57	1.74
Max severity	.24***	.20***	2.27	2.63	0.53	1.63

** p < .01
*** p < .001
Kurt. Absolute kurtosis proper
Perfect normal distribution skewness = 0 and kurtosis = 3
Note: Correlations involving LCA class, '*Any event*', and '*Any event* > 4' are point-biserial and tetrachoric for distress and NSSI respectively, meaning they may not be comparable with other total and factor scores for which correlations are Pearson and point-biserial for distress and NSSI respectively.

Table 8.9
Results from YTS variables predicting distress and NSSI in separate linear and logistic regressions respectively, controlling for gender and age

	Distress			**NSSI**		
	beta (SE)	**t**	**p**	**beta (SE)**	**z**	**p**
Regression 1	**R^2 = .19**			**Pseudo R^2 = .20**		
Trauma number	0.05 (0.01)	3.92	<.001	0.28 (0.10)	2.86	.004
Severity mean	0.04 (0.01)	3.86	<.001	0.22 (0.08)	2.64	.008
Regression 2	**R^2 = .19**			**Pseudo R^2 = .19**		
Trauma number	0.04 (0.01)	2.45	.015	0.23 (0.12)	1.98	.048
Severity max	0.04 (0.01)	3.92	<.001	0.18 (0.08)	2.17	.030
Regression 3	**R^2 = .20**			**Pseudo R^2 = .18**		
Perpetrated f.	0.27 (0.09)	2.96	.003	1.45 (0.67)	2.17	.030
Infirmity f.	0.42 (0.19)	2.23	.026	1.80 (1.34)	1.34	.180

f. = severity factor score

8.6 Discussion

In this chapter I present a new measure of childhood trauma, the Youth Trauma Scale (YTS), and I provide initial evidence for its factor structure and prognostic validity. Although many measures of trauma exist, I feel they all either miss important events or contain items that are largely irrelevant to contemporary adolescents. Moreover, few have undergone any type of psychometric investigation. By combining items from some of these pre-existing measures, and by exploring the structure and validity of the YTS using psychometrically valid techniques, it is my hope that the YTS will be a useful contribution to the filed.

8.6.1 Frequency and distributions

The frequencies of endorsement of the presence of each trauma in the YTS, which range from 6-46%, are in keeping with prior findings that traumatic experiences are not uncommon among community samples of adolescents (Berger et al., 1988) and the general population (Breslau et al., 1998; Frans et al., 2005; Kessler et al., 1995; Kubany et al., 2000). In general, trauma severity ratings ranged across the possible spectrum among participants who reported having experienced a trauma, supporting the importance of examining severity as well as incidence.

Many YTS items were significantly correlated with each other, supporting the idea that traumatic events often co-occur (Dube et al., 2003). This pattern of co-occurrence also indicated that the YTS may a be suitable for dimension reduction methods such as exploratory / confirmatory factor analysis (EFA / CFA) or latent class analysis (LCA).

8.6.2 Exploratory factor analyses

PA indicated retention of two factors for EFA. EFA and CFA yielded similar models for the dichotomous Yes/No items and the ordinal trauma severity items (0-7). These analyses yielded 2 factor models in which items on Factor 1 represented person-perpetrated traumas such as violence, substance abuse, and family discord, and items on Factor 2 were traumatic events not so directly caused by people's decisions, such as illness and injury. These factors were labelled Perpetrated and Infirmity respectively.

Parental unemployment (item 10) can be the result of illness or injury and therefore loaded onto the Infirmity factor accordingly.

The open-ended item 12 loaded significantly onto the Infirmity factor for all three models. Closer examination of participants' description of the event to which they were referring reveals it was often something closely related to illness or injury, such as sibling's mental illness. This indicates that if item 8 was slightly altered to include sibling as well as parent mental illness, some cases of the "other" category might be more specifically classified. While it is impossible and impracticable to make an exhaustive list of all traumatic events, the inclusion of this open-ended question not only facilitates the conveyance of further information about traumas that were not included, but also fits well within the statistical models.

Item 1 (death of a close family member or friend) fit poorly with the factor models and was therefore excluded from subsequent analyses. It was also the most commonly endorsed item, and the most weakly associated with NSSI and distress. Although prior work shows that the death of a close family member or friend are among the most highly distressing events (Hobson et al., 1998), strong associations with negative outcomes such as distress and NSSI would be catastrophic given the frequency with which this item was endorsed. There may, nevertheless, be a pronounced difference in the impact of bereavement on adolescents versus adults, for whom bereavement is strongly associated with depression (Kendler et al., 2010). This may be because in an adolescent sample from a healthy population, bereavement is more likely to be from the death of grandparents or great-grandparents than the more impactful event of parents or siblings dying, compared with a middle-aged population. In order to assess whether this distinction holds, future work could refine item 1 to focus only on death of a parent or sibling, or to focus on unexpected death.

The only difference between CFA models was that item 8 (parental mental illness) loaded onto the Perpetrated factor when the dichotomous items were used, but loaded onto the Infirmity factor when the severity scores were used. This differential loading across models for this item depending on whether severity is taken into account is not that

surprising when considering the literature; mental illness can easily be conceptualised as closely related to both Infirmity and Perpetrated trauma as children of mentally ill parents are exposed to a constellation of adverse circumstances and challenges such as increased risk of neglect and abuse (Aldridge, 2006). Indeed, parental psychopathology has been associated with more frequent negative events overall, indicating it is a risk factor for other forms of trauma (Ian M. Goodyer et al., 1993). Apart from this one difference the overall consistency across the final factor models supports the validity of these models, as does their theoretical interpretability.

8.6.3 Bi-factor analyses

Although traumatic events on the YTS did cluster together into two highly correlated factors in EFA and CFA, models with one underlying general trauma factor performed poorly, would not converge, or had unacceptable model fit. This indicates that despite the correlations between the two EFA/CFA factors, they are indeed distinct, and general specific models are inappropriate, at least for the YTS, if not trauma questionnaires generally. Thus, it appears that although traumatic events cluster together, they do so along at least two distinct factors; people may be more likely to experience or have similar experiences of a particular kind of trauma such as either infirmity related traumas or person perpetrated traumas.

8.6.4 Latent class analyses

As with EFA / CFA, LCA models without item 1 and with item 12 performed best, lending further support to the respective exclusion and inclusion of these items on the YTS and the aforementioned analyses.

LCA on the 'yes/no' items and on the </> 4 trauma severity items indicated 4 and 3 classes respectively that were readily interpretable and meaningful. Both sets of analyses yielded similar 'low trauma', 'family trauma', and 'high trauma' classes lending support to the stability and generalizability of these models regardless of how individual YTS scores are calculated. The '*Yes/No*' LCA yielded one additional class that closely

resembled the EFA/CFA illness and injury factor in terms of items with increased probability of endorsement (>.20).

LCA on the ordinal trauma severity items failed to produce a parsimonious model, potentially indicating that participants can be separated based on their patterns of having experienced traumas but not on the basis of how intensely they experience traumas.

Between LCA classes there were meaningful patterns and differences for NSSI, distress, and gender. However even the most prognostic of these LCA classes proved to be less strongly correlated with NSSI and distress than most continuous scores derived from the YTS (discussed below), suggesting the LCA classes are less prognostically-informative. Therefore the validity of the LCA classes will not be discussed further.

8.6.5 Age and gender differences on YTS scores

The pattern of gender differences on the YTS scores shows that girls are significantly more likely than boys to have experienced traumatic events, particularly Perpetrated traumas. This is at odds with epidemiological findings amongst adults that traumatic events (other than sexual assault) are experienced more frequently by men than women (Frans et al., 2005; Tolin & Foa, 2006). The present data indicates that adolescent girls may be at increased risk of experiencing traumatic events compared to their male peers. This may reverse when these adolescents grow older, however there were no age-gender interactions, indicating that this trend is stable at least from ages 16-18. The finding that women report greater severity of trauma is, however, in keeping with prior research showing that women rate traumatic events as more distressing than men (Frans et al., 2005). There were no significant age or gender interactions between any of the YTS scores predicting distress or NSSI, indicating that although girls report higher trauma severity ratings for events, experiences of trauma are nevertheless equivalently impactful on both boys and girls. This is at odds with the literature demonstrating a higher rates of PTSD among women after traumatic experiences (Frans et al., 2005; Tolin & Foa, 2006), and should be investigated further. As this sample was predominantly female, conclusions about gender effects must be made with caution.

8.6.6 Prognostic associations of individual YTS items with NSSI and distress

In terms of individual YTS items, dichotomising items on the basis of a trauma *severity score </> 4* provided little if any prognostic information over and above a simple '*Yes/No*' split as represented by stronger correlations between YTS scores and either NSSI or distress. In general, the *severity (0-7)* scores demonstrated the highest correlations with both NSSI and distress, though differences from the simple '*Yes/No*' split were small. However, multiple regression using all items did demonstrate that information on severity contributed additional effects on distress and NSSI once number of events was controlled for.

It is noteworthy that sexual trauma was the most strongly linked item to NSSI despite not being the most purportedly severe kind of trauma. This is in keeping with a broad body of literature demonstrating a particularly strong association between sexual abuse and NSSI (Boudewyn & Liem, 1995; Gratz, 2003; van der Kolk et al., 1991). This finding is nevertheless novel in that it suggests the reason for the pronounced association cannot simply be that sexual traumas are particularly severe or distressing but rather that there is something unique about the nature of sexual traumas such as the very personal, physical, and intentional nature of these events (Shakespeare-Finch & Armstrong, 2010).

8.6.7 Prognostic associations of derived YTS scores with NSSI and distress

The factor scores for the dichotomous '*Yes/No*' trauma scores, trauma severity somewhat traumatic (4) or more versus other, and trauma severity (0-7) demonstrated similar correlations with NSSI and Distress. In all three cases, Perpetrated trauma was more strongly correlated with both NSSI and distress than was the Infirmity factor. This is in keeping with prior research in which intentional and/or interpersonal traumas were found to be the strongest predictors of PTSD symptomology (Frans et al., 2005). While the factor scores were more strongly correlated with psychological distress and NSSI compared with almost all of the total scores, this difference was small. Thus the large sample size required and computational complexity of factor analyses may not be justified. This conclusion is further supported by the fact that logistic regression with

number and mean severity of events predicting NSSI demonstrated a higher Pseudo R^2 than a logistic regression with the Perpetrated and Infirmity factors.

Likewise, the LCA scores were more weakly correlated with NSSI and distress than any of the factor scores and most of the total scores. The most informative score deriveable from the LCA for both '*Yes/No*' items and *trauma severity </> 4* was the probability of membership to the 'No trauma' class. As none of the LCA scores outperformed the simple sum severity total score, however, the computational complexity of LCA seems unjustified, and as such these LCA scores were not examined further.

While all Perpetrated trauma total scores performed similarly well, mean severity of events showed the highest correlations with NSSI and distress overall. Regression analyses on the YTS scores show that number and severity of events both account for unique variance in predicting NSSI and distress, in keeping with other research (Frans et al., 2005). Nevertheless, number of events demonstrated only slightly lower correlations with NSSI and distress. Thus it would be reasonable to simplify the YTS to presence/absence of traumas, where brevity is important, as this would eliminate the need to ask about trauma severity and lead to the loss of only a small amount of information. In a prior psychometric investigation of a measure of childhood trauma, a simple sum score was also found to be the most valid method of computing a trauma score (Bremner et al., 2007).

It is noteworthy that the total scores comprising only items from the Perpetrated factor perform similarly (on correlations with outcomes) to the whole scale total scores. This is in keeping with research demonstrating differential prognoses of trauma types, with person-perpetrated traumas being significantly more deleterious (Frans et al., 2005; Hapke et al., 2006; Shakespeare-Finch & Armstrong, 2010). Thus Infirmity items could be removed where brevity is important. Nevertheless, regression analyses showed that items from both factors contributed unique variance in predicting distress, but not NSSI, indicating items on the Infirmity factor do contribute some additional information.

8.6.8 Recommendations for use

In general, findings suggest that, while factor scores yield the most informative way to calculate trauma from the YTS, their limited superiority over simple total scores may be insufficient to justify the requisite large sample size and computational complexity of factor analyses. The process was useful, however, in identifying two distinct factors: Perpetrated traumas and Infirmity related events such as illness and injury. Of these factors, Perpetrated traumas account for the majority of variance in predicting distress and NSSI and as such these items may be able to be used alone as a smaller scale.

Nevertheless, in regression analyses, Infirmity items did contribute some addition unique variance in predicting distress and as such may be valuable if instrument brevity is not a significant consideration. Infirmity (Factor 2) may also have greater practical implications on the adolescent rather than psychological ones, since for example illness and lack of parental employment could each siphon funds away from savings for post-secondary education and even life necessities such as adequate housing and food. As such, Infirmity could be particularly important when other outcomes such as educational attainment are being considered. However, traumas which result in greater immediate psychological impact may also influence outcomes more closely related to Infirmity. Thus, having a measure which contains these distinct traumas together is advantageous in assessing various outcomes over the lifecourse following trauma in childhood and/or adolescence.

I also found that it is the presence or absence of any traumatic event that leads to increased risk of mental health problems, rather than trauma producing an above-threshold level of distress. Taking severity (through a sum of severity scores) into account did contribute additional variance in predicting distress/NSSI over and above simple presence/absence and so is a valuable inclusion in the YTS. However, the benefit of including severity ratings in predicting outcomes was small, and so could be omitted when brevity is an important consideration. However, with other outcomes it is possible that severity ratings may prove more crucial.

Item 1, "death of a very close friend or family member", was uncorrelated with NSSI and distress, and did not load significantly on either factor in EFA. As such, it should not be included in future versions of the YTS.

8.6.9 Limitations

The YTS does not account for repeat traumas of the same type. Future research could investigate the usefulness and validity of replacing the trauma intensity items with items assessing the frequency or length of exposure with which any given trauma was experienced, in keeping with the format of instruments such as the CATS, CTQ, and TLEQ.

Some of the specific items in the YTS also had shortcomings. The injury component of item 6, 'Were you extremely ill or injured', could be conflated with item 4, 'Were you the victim of violence'. Future versions of the YTS could explore the validity of rephrasing item 6 to 'Were you extremely ill or severely injured in an accident'. The same issue of conflation applies to items 7 and 5, which pertain to sibling injury and violence respectively. The phrasing of item 8, 'Did a parent suffer from mental illness or depression', erroneously distinguishes between depression and other mental illnesses. In future versions of the YTS, the item could be replaced with 'Did a parent suffer from mental illness such as depression or anxiety'. Although these item were taken verbatim from the Childhood Traumatic Events Scale (CTE) (Pennebaker & Susman, 1988), I believe the suggested amendments would at least improve the face validity of the YTS. Likewise, item 9, 'Were you separated from your mother for more than 1 year?', perhaps erroneously assumes that mothers are the primary caregivers for all participants, and may not be valid or relevant where the primary or sole caregiver is the father. Future versions of the YTS could test the validity of replacing this item with 'Were you separated from your primary caregiver (parent) for more than 1 year?'. While the YTS does not contain all possibilities of experienced trauma, as it is based on merging 5 pre-existing measures I believe not only does it contain key traumas but is more encompassing than any previous measures.

8.7 Conclusion

The YTS comprises items from two distinct factors: Perpetrated traumas and Infirmity related events such as illness and injury. For maximum information, items including severity ratings should be included, and sum of severity scores derived. For a shorter scale it would be reasonable to include simple presence/absence of the seven items within the person-perpetuated traumas sub-scale. Although further validation with other measures of trauma and longitudinal measures of predictive validity is needed, the YTS appears to be a comprehensive and psychometrically valid measure of early traumatic experiences, redressing a gap in the existing body of available measures.

Chapter 9

A multivariate path model of risk factors for NSSI

Having demonstrated the validity of the Youth Trauma Scale (Chapter 8), and identified some of the meditational pathways from child-parent relationships to NSSI (Chapter 6) and early adversity to NSSI (Chapter 3), I will now explore all of these pathways together in a single multivariate model of adolescent NSSI using cross-sectional data collected for these purposes.

Abstract

Background: The trauma-NSSI association appears to be mediated by continued family dysfunction, and the parenting-NSSI association appears to be mediated by psychological distress, however no one study has explored all of these factors and pathways together in a single multivariate model of adolescent NSSI.

Aims: I conducted path analysis, testing a model in which trauma impacts parent and peer attachment security, which is in turn associated with increased psychological distress, an acute risk factor for NSSI.

Methods: A community sample of 596 adolescents (138 male, 445 female, 11 other) aged 16-19 (m = 17.24, SD 0.67) completed self-report measures of recent and lifetime NSSI, lifetime traumatic experiences, present parent and peer attachment, and recent impulsivity and psychological distress. The key outcome was recent NSSI versus no lifetime NSSI.

Results: Analyses supported a model in which psychological distress mediated the associations between insecure attachment and NSSI, and attachment and distress mediated the association between trauma and NSSI. Secure attachment also moderated the trauma-NSSI association, indicating it may be a protective factor. Negative urgency was uniquely associated with NSSI over and above other risk factors. Trauma also had direct effects on psychological distress and NSSI.

Conclusion: Reducing trauma is likely to reduce NSSI. Psychological distress, and parent and peer attachment, are potentially useful areas of therapeutic focus for reducing the risk of NSSI conferred by trauma. Impulsivity, in particular impulsivity in the context of negative affect, may also be a risk factor for future engagement in NSSI.

9.1 A multivariate path model of risk factors for NSSI

In previous chapters I demonstrated some prospective associations between parenting, distress, trauma, and NSSI. I also demonstrated meditational pathways from parenting to NSSI through distress, and from trauma to NSSI through continued family dysfunction. However no study has yet examined all of these risk factors and pathways to NSSI together in a single multivariate model. I will do so in the present study, addressing calls for NSSI models that test mediations, moderations, and effects of multiple risk and protective factors together (Fliege et al., 2009), and further work on the role of family relationships with regards to NSSI (Hawton & Harriss, 2008).

Hypotheses

In this chapter I set out to test the following hypotheses and path models of risk factors for recent NSSI, controlled by lifetime NSSI.

I. The association between trauma and NSSI is mediated by attachment: trauma impairs attachment and insecure attachment is a risk factor for NSSI.
II. The association between trauma and NSSI is mediated by distress: trauma is distressing and distress is a risk factor for NSSI. The association between attachment and NSSI is mediated by distress: insecure attachment is distressing and distress is a risk factor for NSSI.
III. Impulsivity is independently associated with NSSI.

The model will also allow for direct associations between trauma and distress, trauma and NSSI, and attachment and NSSI (Figure 9.1).

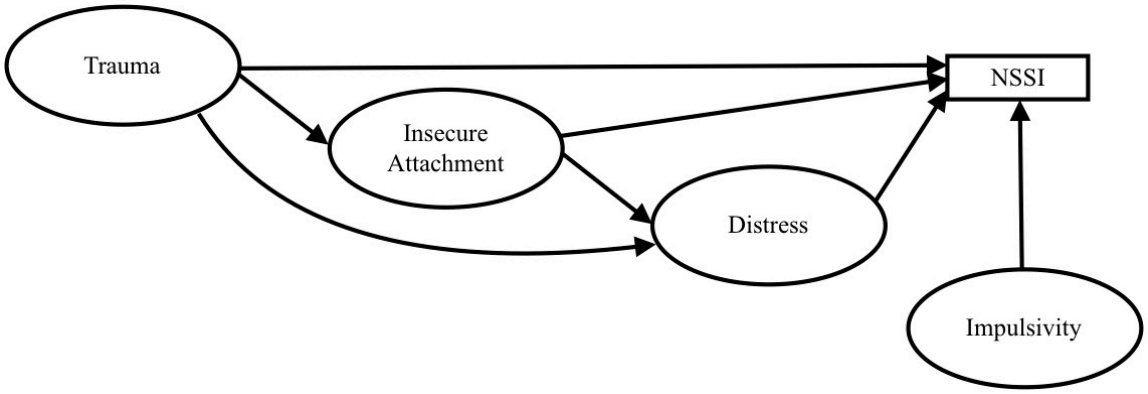
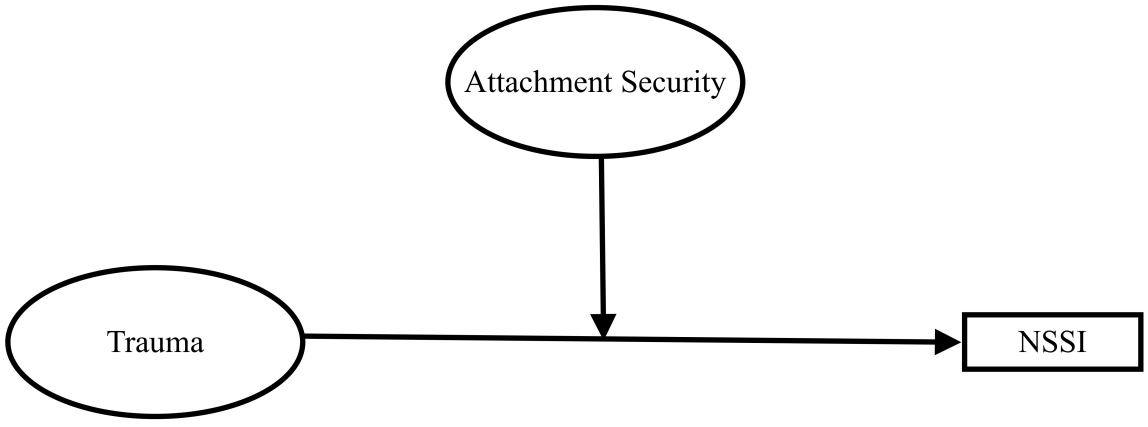


Figure 9.1. Proposed path model for adolescent NSSI.

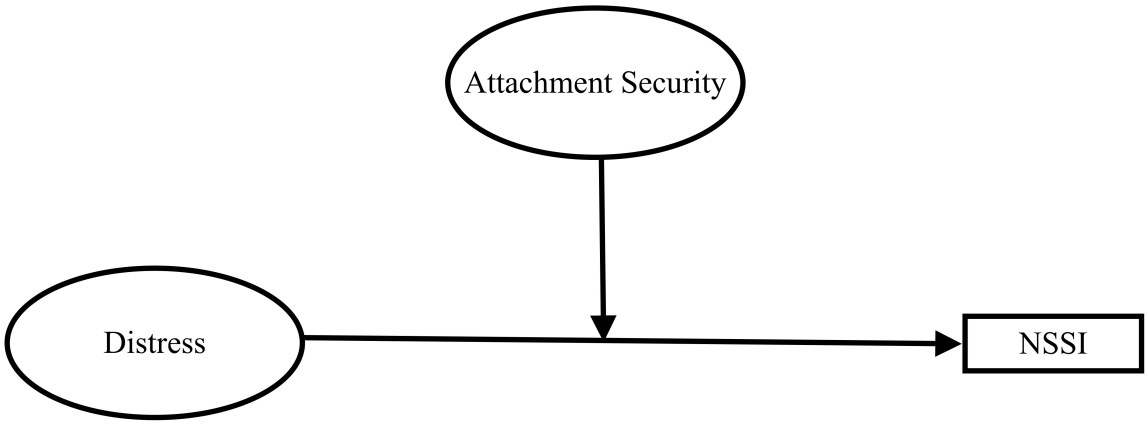
In addition to the above pathways, I will test the following moderation hypotheses:

IV. Attachment moderates the associations between trauma and both distress and NSSI: strong relationships are an important protective factor, mitigating the distress cause by trauma, and serving as an outlet for communicating and alleviating distress (Figure 9.2).

V. Insecure child-parent and child-peer attachment are multiplicatively impactful: adolescents can use either parents or peers as social support, but when attachments to both are insecure adolescents are at a pronounced risk for NSSI.



9.2a



9.2b
Figure 9.2. Moderation of trauma (a) and distress (b) on NSSI by attachment.

9.2 Methods

For details of SAHRE participants, procedures, and measures, see Chapter 7.

9.2.1 Analysis procedure

The path model displayed in Figure 9.1 was tested with generalized structural equation modelling (GSEM). Before this full model was tested, I examined how different dimensions of impulsivity and attachment are related to NSSI with multiple logistic regressions. As the person-perpetrated factor on the Youth Trauma Scale accounted for the majority of variance in predicting both NSSI and distress (see Chapter 8), only this factor was used in the present study. Interaction terms in logistic regressions were used to test the moderating effects of attachment on the associations between trauma, distress, and NSSI. Indirect effects of the final model were tested with MPlus version 7.2 (Muthén & Muthén, 2012) using Monte Carlo integration. All other analyses were run on STATA 14 (StataCorp, 2015).

9.3 Results

9.3.1 Gender differences in key variables and NSSI rates

Of the 596 participants that reported on NSSI behaviour, 282 (48%) reported having engaged in NSSI at some point in their lives, and 94 (16%) reported having engaged in NSSI in the past month. Rates of lifetime and recent NSSI by gender are shown in Table 9.1, with highest rates found in "other" gender, followed by girls, and then boys.

Table 9.1
Rates of lifetime and recent NSSI, and person-perpetrated trauma by gender

	Lifetime n (%)	Past month n (%)	Never n (%)
Male	43 (31)	8 (6)	95 (69)
Female	231 (52)	81 (18)	211 (48)
Other	8 (73)	5 (45)	3 (27)
Fisher's exact p	<.001	<.001	

Descriptive statistics for all other variables split by gender are shown in Table 9.2 as well as comparison statistics between participants who identify as male or female. All further analyses controlled for gender as an unordered three-level categorical covariate. Participants identifying as female reported greater distress, person-perpetrated trauma, parental alienation, peer communication, and negative urgency, and males reported greater sensation seeking.

9.3.2 Correlations between key variables and recent NSSI

In order to limit the potential of reverse causality, all subsequent analyses on NSSI contrast participants who reported engaging in NSSI within the past month (n = 94) against those who had never engaged in NSSI (n = 308). Pearson correlations between key variables, and point biserial correlations between NSSI and key independent variables are displayed in Table 9.3.

Table 9.2
Descriptive and comparison statistics for continuous variables by gender

	Male m (SD)	Female m (SD)	Other m (SD)	Comparison t	p
Distress	-0.18 (0.42)	0.06 (0.46)	0.23 (0.36)	-5.54	<.001
Trauma	-0.02 (0.34)	0.07 (0.37)	0.26 (0.48)	-2.61	.009
Parent attachment					
Trust	3.73 (0.85)	3.68 (0.90)	3.21 (0.97)	0.60	.548
Communication	3.09 (0.88)	3.06 (0.92)	2.61 (0.79)	0.37	.708
Alienation	2.57 (0.85)	3.79 (0.96)	3.19 (0.70)	-2.42	.016
Peer attachment					
Trust	3.81 (0.75)	3.88 (0.77)	4.14 (0.74)	-0.84	.400
Communication	3.46 (0.84)	3.66 (0.77)	4.14 (0.55)	-2.60	.010
Alienation	2.58 (0.72)	2.70 (0.75)	2.71 (0.57)	-1.71	.087
Impulsivity					
Negative urgency	2.42 (0.63)	2.63 (0.64)	2.69 (0.70)	-3.41	<.001
Premeditation	2.84 (0.45)	2.88 (0.44)	2.73 (0.59)	-1.04	.300
Perseverance	2.74 (0.52)	2.74 (0.52)	2.27 (0.58)	0.18	.859
Sensation seeking	2.92 (0.53)	2.71 (0.60)	2.40 (0.77)	3.69	<.001
Positive urgency	2.00 (0.63)	1.99 (0.62)	2.48 (0.77)	0.19	.847

Only 525 participants reported on their age. I suspect the particularly low response rate on this one item is due both to concerns over anonymity and the fact that personally identifiable information such as birthdate was collected on a separate form. Age was not associated with NSSI nor was there a significant age by gender interaction in logistic regressions predicting recent NSSI ($p = .40$). Thus age was not included in subsequent models. However, all analyses were also run controlling for age on the smaller sample that reported on age; these analyses yielded no meaningfully different results from those reported below.

9.3.3 Multiple regressions of grouped variables predicting NSSI

In order to determine which specific aspects of attachment and impulsivity are uniquely associated with NSSI, separate multiple logistic regressions were run for the subscales of the UPPS-P, the IPPA parent, and the IPPA peer predicting recent NSSI and controlling for gender. Results of these three multiple regressions are shown in Table 9.4.

Table 9.3

Table 9.4
Results from logistic regressions of UPPS-P and IPPA subscales predicting NSSI

	beta (SE)	z	p
Parental attachment	**R^2 = .28**		
Trust	0.34 (0.29)	1.20	.323
Communication	-0.12 (0.31)	-0.39	.694
Alienation	1.59 (0.26)	6.09	<.001
Peer attachment	**R^2 = .26**		
Trust	0.40 (0.38)	1.08	.282
Communication	-0.22 (0.34)	-0.65	.514
Alienation	1.84 (0.27)	6.76	<.001
Impulsivity	**R^2 = .33**		
Negative urgency	2.05 (0.36)	5.77	<.001
Premeditation	-0.17 (0.40)	-0.43	.665
Perseverance	-0.76 (0.32)	-2.41	.016
Sensation seeking	-0.68 (0.29)	-2.35	.019
Positive urgency	0.04 (0.33)	0.13	.895

9.3.4 Path analysis

As only the alienation subscales of both the parents and peer IPPA were uniquely associated with NSSI, these are the only measures of attachment that were included in the GSEM of the final path model. Likewise, only negative urgency, perseverance, and sensation seeking were included as measures of impulsivity. Results of these analyses are shown in Figure 9.3. Impulsivity and gender were controlled for at every level of analyses, however only the direct effects of these variables on NSSI are displayed for clarity sake. Statistics are shown only for direct effects from this model, however the indirect paths to NSSI, displayed in Table 9.5, were all significant (all $p < .001$).

Table 9.5
Indirect paths to NSSI

Indirect paths to NSSI	Estimate	SE	p
Parent alienation-distress	0.80	0.17	<.001
Peer alienation-distress	0.72	0.17	<.001
Trauma-parent alienation	0.07	0.01	<.001
Trauma-peer alienation	0.04	0.01	<.001
Trauma-distress	0.27	0.07	<.001
Trauma-parent alienation-distress	0.29	0.07	<.001
Trauma-peer alienation-distress	0.15	0.04	<.001

Figure 9.3

9.3.5 Moderation

In order to limit the number of comparisons, only the alienation subscale of attachment was examined for moderation effects. Child-parent and child-peer alienation did not moderate the associations between NSSI and distress, negative urgency, or parent/peer alienation, all $p > .50$. Child-parent alienation did moderate the trauma-NSSI association ($b = -1.01$, $z = -2.22$, $p = .026$), such that the trauma-NSSI association is more pronounced among participants with greater alienation from their parents. None of the impulsivity subscales moderated the distress-NSSI association; all $p > .60$.

9.4 Discussion

Addressing calls for studies in which multiple risk and protective factors for non-suicidal self-injury (NSSI) are studied together (Fliege et al., 2009; Maniglio, 2011), I tested a multifaceted path model investigating the role of attachment and psychological distress in mediating the trauma-NSSI association. I found evidence to support this model. At the univariate level, person-perpetrated trauma was associated with insecure attachment, in keeping with findings from Chapter 3 and the idea that trauma can be deleterious to attachment (Hughes, 2004); trauma was associated with decreased trust and communication, and increased alienation. Parent and peer alienation were in turn associated with increased psychological distress in keeping with the body of evidence that secure attachment plays an important role in emotion regulation (Cozolino, 2014; DeKlyen & Greenberg, 2008). Finally, distress is a robust proximal risk factor for NSSI, as expected (Nixon et al., 2008). Psychological distress completely mediated the influence of parent and peer alienation on NSSI, in keeping with previous findings that much of the association between poor child-parent relationships and NSSI may be due to the psychological distress resulting from insecure attachment (Gandhi et al., 2016; Hallab & Covic, 2010; Kelada et al., 2016; Kimball & Diddams, 2007; Tatnell et al., 2014).

In addition, trauma had a direct effect on psychological distress not accounted for by the association between trauma and insecure attachment. This is unsurprising given that

traumatic events are by definition inherently distressing over and above the distress that may be caused by impairments in attachment. However, trauma also had a direct effect on NSSI not accounted for by associations between trauma and any other risk factors for NSSI including: gender, parent and peer attachment, impulsivity, and psychological distress. This direct association between trauma and NSSI indicates there may be other unobserved psychological corollaries of trauma beyond general psychological distress that act as additional risk factors for NSSI. Other researchers have proposed for example that the very personal, physical, and intentional nature of sexual trauma explains the pronounced association between these events and NSSI (Shakespeare-Finch & Armstrong, 2010). Many victims of child abuse also struggle with profound feelings of guilt (Wolfe et al., 1994). These people may be engaging in NSSI as a form of self-punishment, which is another commonly noted motivation for engaging in NSSI (Laye-Gindhu & Schonert-Reichl, 2005). These other pathways from trauma to NSSI warrant further investigation as they may indicate additional areas of potential therapeutic intervention.

The indirect pathway from insecure attachment to NSSI through distress was significant, but the direct effect of parent and peer attachment on NSSI disappeared when this indirect pathway was included in the model. This finding suggests that secure attachment is associated with decreased risk of NSSI by reducing levels of contingent psychological distress. I also found that low alienation, or secure attachment, moderated the risk for NSSI conferred by traumatic experiences. Together these findings indicate that treating parent and peer alienation may reduce risk of NSSI through three mechanisms: as alienation is an intermediate variable (mediator) on the trauma-NSSI pathway, reducing alienation will reduce the risk for NSSI conferred by trauma through alienation; as distress mediates the alienation-NSSI association, reducing alienation will reduce contingent psychological distress and the risk for NSSI conferred thereby; finally, alienation moderated the trauma-NSSI association, indicating low alienation acts as a protective factor against the impact of trauma. However, attachment-based therapy is unlikely to completely negate the impact of trauma as there were direct associations between trauma and both distress and NSSI.

In terms of specific aspects of attachment, only the subscale measuring anger and alienation was uniquely associated with NSSI for both parent and peer attachment. This subscale comprises items related to dissatisfaction, negative feelings, and a lack of understanding from parents. It is interesting that the two other subscales of the IPPA, Trust and Communication, were not associated with NSSI, suggesting that Alienation, or feelings of emotional disconnect from parents is more salient to NSSI than communication or trust. This is in keeping with the idea posited in Chapter 2, that some adolescents may engage in NSSI in order to find out if their parents care about or love them.

In regards to the different facets of impulsivity measured by the UPPS-P, only negative urgency remained significantly associated with NSSI when other risk factors for NSSI were included in the model. The pronounced association between NSSI and negative urgency over other UPPS-P subscales replicates findings of Hamza and colleagues (2015), and is in keeping with the idea that NSSI is generally a reaction to negative emotions (Klonsky, 2007). However, interactions between impulsivity and distress were non-significant, indicating that while impulsivity and distress are both independently associated with NSSI, the effect is additive rather than multiplicative. This may however explain why most laboratory measures of impulsivity have not detected an association with NSSI (Hamza et al., 2015; Liu et al., 2017), apart from the one study in which emotionally valenced stimuli were used (K. J. D. Allen & Hooley, 2015), as impulsivity in the context or response to negative emotions appears to be the most salient to NSSI.

9.4.1 Limitations

This study has several limitations, the most significant of which is its cross-sectional design, which severely limits the extent to which conclusions of causality can be drawn from its findings. While a longitudinal design would have enabled clearer conclusions of causality to be drawn from these analyses, the low rate of new onset of NSSI (Hankin, & Abela, 2011) and the relatively stable characteristics of attachment (Kirkpatrick, & Hazan, 1994) would necessitate a long period of time between assessments (likely at least

one year) in order to detect prospective associations between changes in these factors. Such a project would be prohibitively lengthy for a PhD.

In an attempt to control for the possibility of reverse causation, analyses with NSSI contrasted participants who reported engaging in NSSI within the past month against those who had never engaged in NSSI. Moreover, prospective associations with impulsivity, child-parent relationships, psychological distress, and trauma predicting NSSI were previously demonstrated with longitudinal studies in Chapters 3 and 6. Likewise, while child-parent relationships predict distress one year later, the converse is not true (Chapter 5), in keeping with a large body of literature demonstrating the broad impact of child-parent relationships on children's emotional wellbeing (DeKlyen & Greenberg, 2008). Finally, the measure of trauma was the only lifetime measure used in these analyses. Thus, the reported traumatic experiences are likely to have predated the periods of assessment covered by the measures of distress, attachment, and impulsivity.

Another shortcoming of this study is that the instrument used for measuring parent and peer attachment, the IPPA, does not distinguish between mother and father when asking questions about child-parent attachment. This is problematic in that there is some evidence suggesting that paternal attachment is more strongly associated with NSSI than maternal attachment (Hallab, & Covic, 2010). Nevertheless, the IPPA was selected as it is a widely used (Cotterell, 1992; Meeus et al., 2002; Papini & Roggman, 1992; M. Smith et al., 2009; Ying et al., 2007) and well validated (Armsden & Greenberg, 1987; Lapsley et al., 1990) brief self-report measure of attachment across multiple domains.

The sample is also not representative. Although the sample is population based, I was explicit during recruitment that this study focused on trauma, NSSI, and psychological distress, and as such, participants undoubtedly were influenced by strong self-selection bias. Indeed, the prevalence of lifetime engagement in NSSI in this sample (n = 282, 48%) is far higher than adolescent population prevalence estimates of between 17 and 29% (Plener et al., 2009; Swannell et al., 2014). Thus, inferences of population wide rates of trauma, NSSI, and distress cannot be made, however the associations between these variables in this sample should nevertheless be generalizable. The sample was also

predominantly (73%) female meaning that although gender was controlled for in analyses, the extent to which the present findings can be generalised to adolescents identifying as male is unclear.

9.5 Conclusion

This study is unique in that it looks at the influence of person-perpetrated trauma on both parental and peer attachment, and in turn, the influence of attachment on psychological distress and subsequent NSSI. Findings replicated those from previous chapters, demonstrating together that trauma, insecure attachment, and psychological distress are risk factors for adolescent NSSI. Moreover, insecure attachment once again appeared to mediate the trauma-distress association, and distress mediated the associations between NSSI and both trauma and insecure attachment. Impulsivity, in particular negative urgency, may also be a risk factor for future engagement in NSSI. Addressing impulsivity problems (for example through psychological training) may be an effective means of lowering the risk of NSSI or even of treating recurrent NSSI among young people.

Chapter 10

Risk factors for NSSI among young adolescents

The majority of research (my own included) on NSSI has focused on older adolescent samples. Many cases of NSSI, however, begin at younger ages. In this chapter I shall present analyses on longitudinal data from a sample of Flemish students, collected when they were 13 years old, and again a year and a half later.

Abstract

Background: The majority of research on NSSI has focused on samples that are 16 years or older, however NSSI can arise as early as age 7. In order to better understand the aetiology of this behaviour we must study it at the time of its emergence.

Methods: 559 community-recruited 13 year-old (m = 12.71, SD = 0.32) Flemish students (41.1% male) provided data on NSSI both at baseline and at a one-and-a-half-year follow-up. NSSI was assessed with a single dichotomous item. Insecure attachment was measured using the Experiences in Close Relationships – Revised scale. Psychological adjustment was assessed with the Strengths and Difficulties Questionnaire.

Results: Conduct problems, hyperactivity, and avoidant attachment at age 13 and conduct and emotion problems at age 14 were correlated with NSSI. Conduct and peer problems at age 13 were predictive of new NSSI by age 14. Finally, cross-sectional analyses at age 13 indicated that the association between avoidant attachment and NSSI may be mediated by hyperactivity and conduct problems.

Conclusion: These findings suggest behavioural problems may more salient to NSSI than are emotional problems among young adolescents. Interventions to improve behavioural problems, in particular conduct problems, may reduce NSSI among young adolescents. Attachment-focused therapies may be effective at reducing child NSSI either directly, or by improving hyperactivity and conduct problems.

10.1 NSSI among young adolescents

The majority of research on NSSI is focused on samples that are 14 or older, however the mean age of onset of NSSI is around 14-15 years (Nixon et al., 2008), and a recent meta-analysis (Plener et al., 2015) identified a sharp rise in NSSI as early as age 12. Indeed, a few studies have even identified children as young as 7 years old engaging in NSSI (Barrocas, Hankin, Young, & Abela, 2012; Hilt, Cha, & Nolen-Hoeksema, 2008). Studies on prevalence of NSSI in child and young adolescent populations are scarce, but point prevalence rates at ages 10-14 are estimated to be around 5-8% (Hilt, Nock, et al., 2008), and retrospective reports among older populations consistently document of age-of-onset under the age of 11 in 5% to 24% of people who self-injure (Heath, Toste, & Beettam, 2006; Ross & Heath, 2002; Whitlock, Eckenrode, & Silverman, 2006).

In order to better understand the aetiology of this dangerous and potentially addictive behaviour (Hawton, Fagg, Simkin, Bale, & Bond, 2000), it is necessary to study factors associated with its early emergence in young populations. A handful of recent studies have examined NSSI in non-clinical samples of young adolescents with the longitudinal follow up necessary to discern prospective risk factors for new emergence of NSSI. These have demonstrated a number of prospective risk factors for new onset of NSSI, including: female gender, emotional and behavioural problems (Sourander et al., 2006), recent stressful life events, and interpersonal problems (Hankin & Abela, 2011; Tatnell et al., 2016). In particular, family factors such as family dysfunction (Chitsabesan, Harrington, Harrington, & Tomenson, 2003; Hawton et al., 2012; Vajani, Annest, Crosby, Alexander, & Millet, 2007), poor parent-child relationships (Bjärehed & Lundh, 2008; Lundh, Wångby-Lundh, Paaske, Ingesson, & Bjärehed, 2011), maternal health problems, and living in a non-intact household (Sourander et al., 2006), appear to be closely related to self-harm in this age group. Indeed, family discord is one of the most common factors associated with self-harm among young adolescents presenting with self-harm to emergency departments in both America (Vajani et al., 2007) and the UK (Hawton & Harriss, 2008), and among a community sample of Swedish students (Bjärehed & Lundh, 2008).

Among young adolescents, insecure attachment is associated not only with NSSI (Tatnell et al., 2016, 2014; Yates, Tracy, et al., 2008), but also with behavioural problems such as attention deficit hyperactivity disorder (Clarke et al., 2002), and emotional problems such as depression and anxiety (Irons & Gilbert, 2005; Muris, Meesters, van Melick, & Zwambag, 2001; Papini & Roggman, 1992). In turn, both internalizing (e.g., personal identity and emotional wellbeing) and externalizing (e.g., behavioural and interpersonal) problems are prospective risk factors for NSSI among young adolescents (Sourander et al., 2006; Tatnell et al., 2016). Thus, emotional and behavioural problems may represent a pathway through which insecure attachment increases the risk for an early onset of NSSI (Gandhi et al., 2016; Hallab & Covic, 2010; Kimball & Diddams, 2007). While previous cross-sectional evidence suggests that behavioural problems may be particularly salient to NSSI among young adolescents (Lundh, Karim, & Quillish, 2007), and longitudinal work suggests that intrapersonal factors like self-esteem may mediate the relationship between insecure attachment and NSSI (Tatnell et al., 2014), the indirect pathway from child-parent and child-peer attachment to NSSI through multiple specific indices of adjustment has not been previously investigated in a large, non-clinical sample of young adolescents.

Hypotheses

Using longitudinal data from a non-clinical sample of young adolescents, I explored how emotional, behavioural, and peer relationship problems (hereafter collectively referred to as adjustment), and attachment contribute to NSSI behaviour. I tested the following hypothesis: the association between attachment and NSSI is mediated by adjustment (shown in Figure 10.1).

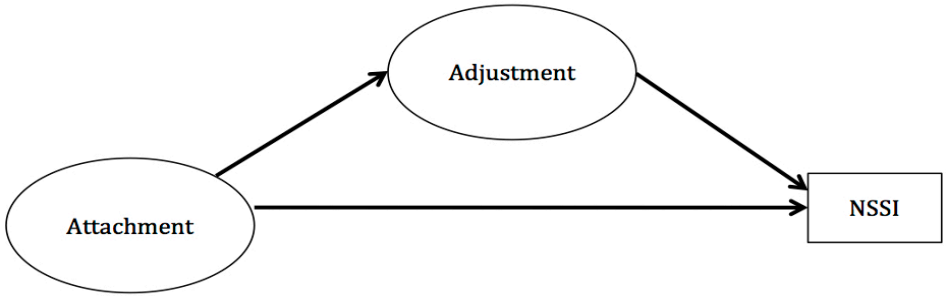


Figure 10.1. Path diagram of the proposed model of potential pathways from insecure attachment to NSSI, both directly and through adjustment.

10.2 Methods

10.2.1 Participants and procedure

Data for this study were drawn from the JOnG! project, a three-wave prospective cohort study of Flemish adolescents, recruited from nine regions in Flanders. Data collection and compilation were conducted completely by researchers other than myself. A full description of procedure and participants has been reported elsewhere (Baetens et al., 2014). The JOnG! study tracks the development of mental health, family relationships, and healthcare from preadolescence until adolescence using multi-informant questionnaires (parent and adolescent questionnaires). All participants, both children and parents, gave active informed consent for their data to be used. Additionally, a parent or legal guardian provided active informed consent for the child-report data. The study procedures were approved by the Ethics Committee of both universities cooperating in the JOnG! project.

In March 2009, all parents of twelve-year old adolescents living in 9 regions of Flanders (N = 9861; 14% of all twelve-year olds in Flanders) were invited to participate in this study. For the current study purposes, I focused on the age 13 and age 14 child-report questionnaires, hereafter referred to as T1 and T2. The sample comprised 559 participants (41.1% male, n = 230) who provided data at both time points. None of the study variables were related to attrition (all $p > .15$) suggesting that missingness did not impact findings.

10.2.2 Measures

NSSI: Engagement in NSSI was determined by an affirmative response to the item 'Have you ever intentionally injured yourself (e.g., cut, burn, scratch), without the intent to die?'

Attachment: Child parent attachment was measured using the *Experiences in Close Relationships – Revised Child* (ECR-RC) version (Brenning, Soenens, Braet, & Bosmans, 2011), a child-appropriate adaptation of the Experiences in Close Relationships Scale-Revised (Fraley, Waller, & Brennan, 2000). The ECR-RC is a self-report questionnaire comprising 36 items across two subscales: avoidant attachment (avoidance of intimacy and reliance on others) and anxious attachment (fear of abandonment and rejection). Only

items about child-mother relationship were used in the present study. These subscales showed high internal validity: avoidant $\alpha = .93$ and anxious $\alpha = .88$. Attachment was only measured at T1.

Adjustment: The *Strengths and Difficulties Questionnaire* (SDQ) (Goodman, 2001) is a reliable and valid screener of psychological difficulties across different domains (Muris, Meesters, & van den Berg, 2003; B. Van Roy, Veenstra, & Clench-Aas, 2008). The SDQ yields scores for the following scales: emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems and pro-social behaviours. In previous studies the SDQ has shown strong cross-sectional associations with NSSI among young adolescents, particularly the Hyperactivity and Conduct scales (Lundh et al., 2007), but also the Emotion (Northern, 2008) and Peer problem subscales as well (Resch et al., 2008).

10.2.3 Analysis procedure

As few studies of NSSI have been conducted with young adolescents I began my analyses by examining cross-sectional relationships between potential risk factors and NSSI. I initially tested NSSI associations with demographic variables, as these may confound other results. Based on these analyses, gender and parent employment were entered as covariates in all subsequent analyses where these were not primary variables of interest.

Associations between adjustment (as measured by SDQ) and attachment with NSSI were measured cross-sectionally (at T1 and T2) and longitudinally (from T1 to T2).

There are three possible associations between attachment, adjustment, and NSSI:

1. Adjustment may mediate the association between attachment and NSSI
2. Adjustment and attachment may be independently associated with NSSI
3. Attachment may moderate the associations between adjustment and NSSI

As measures were only administered at two time points, it may be difficult to distinguish between relationships 1 and 2. Therefore when attachment was found to be associated

with NSSI, I tested both a mediation pathway (using the user-written binary logistic mediation package (Ender, 2011) for STATA (robust confidence intervals for direct and indirect effects were estimated using 2000 bootstrap repetitions), and an independence pathway using multiple logistic regression. I tested the moderation pathway by adding adjustment x attachment interaction terms to the regressions.

Differences in the strength of associations between NSSI and SDQ scores across time points were investigated with time x SDQ subscale interactions in individual logistic regressions. Gender x time, and gender x SDQ and attachment interactions were investigated by the same methods. Any significant interactions were followed up with separate logistic regressions at both the univariate and multivariate levels.

Analyses were conducted using STATA, version 11 (StataCorp. 2009). A threshold of 5% was used for statistical significance, as predictor variables were correlated and only one primary outcome variable was used.

10.3 Results

Table 10.1 shows descriptive statistics of the 559 participants that provided T2 NSSI data.

10.3.1 Cross-sectional associations with NSSI

No demographic variables were significantly associated with NSSI at T1. At T2, only female gender [risk ratio = 3.07 (1.14-8.26), Chi^2= 5.41 p =.024] and parent employment [risk ratio = 1.70 (1.16-2.48), Chi^2= 9.30 p =.010] were associated with NSSI (all other p > .07).

Table 10.2 shows cross-sectional associations between NSSI engagement and SDQ and attachment scores at T1 and T2 controlling for gender and parent employment. At T1, avoidant attachment, and SDQ prosocial, hyperactive, and conduct were significantly associated with NSSI. This did not change when SDQ and attachment scores were

Table 10.1
Descriptive statistics of the 559 participants with T2 NSSI data

	n valid	m	SD
Age	537	12.71	0.32
	n valid	**n = yes**	**% Yes**
T1 NSSI	559	16	2.86
T2 NSSI	559	26	4.65
Both parents Belgian	554	513	92.60
Single parent family	550	53	9.64
Parent education	553		
Higher secondary		128	23.15
Low skilled		27	4.88
University		398	71.97
Parent employment	555		
2 employed		407	73.33
1 employed		136	24.50
0 employed		12	2.16
Parent income	458		
Low		16	3.49
Average		175	38.21
High		267	58.30

Table 10.2
Cross sectional associations [beta (95% CI)] between risk variables and NSSI

	T1 NSSI		T2 NSSI
	Step 1	**Step 2**	**Step 1**
Gender	1.88 (0.57-6.25)	1.23 (0.28-5.32)	2.06 (0.67-6.35)
Parent employment	1.02 (0.55-1.88)	0.78 (0.40-1.54)	1.65* (1.10-2.48)
T1 Attachment			
Avoidant	1.05** (1.02-1.08)	1.03* (1.00-1.07)	
Anxious	1.01 (0.98-1.05)	0.99 (0.95-1.04)	
SDQ			
Prosocial		1.52* (1.00-2.32)	0.99 (0.75-1.31)
Hyperactive		1.56** (1.15-2.12)	0.98 (0.81-1.19)
Emotion		1.24 (0.88-1.76)	1.32* (1.06-1.63)
Conduct		1.63* (1.05-2.52)	1.60* (1.12-2.28)
Peers		1.16 (0.81-1.65)	0.99 (0.74-1.32)

* significant at < .05
** significant at < .01

entered separately or together in multiple regression. At T2, parent employment, and SDQ emotion and conduct were significantly associated with NSSI.

A significant time interaction was found for hyperactivity ($p = .009$), indicating that hyperactivity was more closely related to NSSI at T1 than T2. All other SDQ by time interactions were non-significant (all $p > .580$). The gender by time interaction was non-significant ($p = .640$). At T2 there was a significant interaction between prosocial and gender ($p = .025$) where lower prosocial scores were significantly associated with NSSI for girls ($b = -.34$, $p = .015$) and non-significantly correlated with NSSI for boys ($b = .52$, $p = .136$). The T2 gender by prosocial interaction remained significant in the multivariate model ($b = -0.81$, $p = .034$), however when this model was split by gender prosocial was not significantly associated with NSSI for boys ($b = 0.61$, $p = .087$) or girls ($b = -0.18$, $p = .255$). All other gender by SDQ subscale and gender by attachment interactions were non-significant (all $p > .120$).

10.3.2 Prospective associations with NSSI

Table 10.3 shows prospective associations between new engagement in NSSI at T2, and T1 SDQ and attachment scores controlling for gender and parent employment. T1 attachment did not predict T2 NSSI. T1 SDQ conduct and peer problems were both significantly predictive of new NSSI by T2.

All gender by SDQ and attachment interactions were non-significant (all $p > .080$).

10.3.3 From attachment to NSSI through significant correlates at T1

As attachment was not associated with T2 NSSI, I did not test mediation for T2 NSSI. Results from the mediation analyses of T1 data are shown in Figure 10.2. The indirect paths from T1 avoidant attachment to T1 NSSI through T1 Hyperactive and Conduct were significant, as was the direct path from attachment to NSSI. The indirect path through Prosocial was not significant.

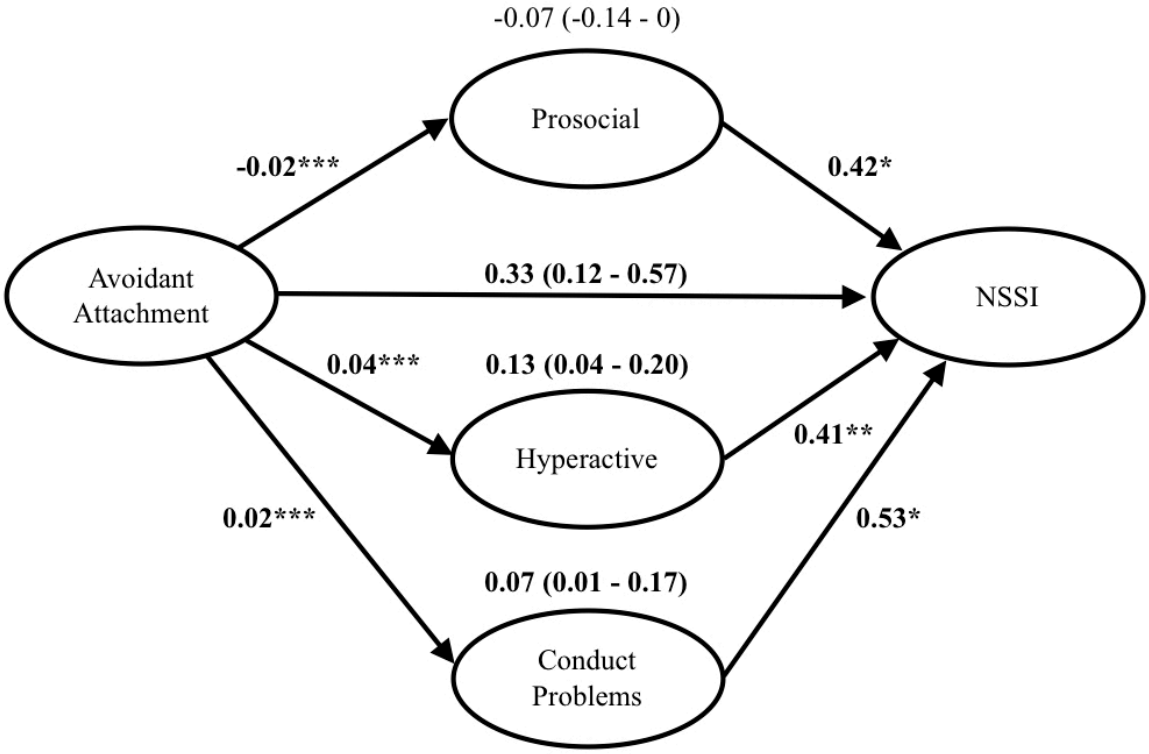
Table 10.3
Prospective associations [beta (se)] between T1 variables and new NSSI by T2

	New NSSI by T2	
	Step 1	**Step 2**
Gender	2.46 (0.66-9.22)	4.16 (0.90-19.15)
Parent employment	2.16** (1.26-3.69)	1.83* (1.01-3.32)
T1 Attachment		
Avoidant	1.01 (0.98-1.04)	0.98 (0.94-1.02)
Anxious	1.00 (0.96-1.05)	0.99 (0.95-1.04)
T1 SDQ		
Prosocial		0.90 (0.62-1.31)
Hyperactive		0.85 (0.60-1.21)
Emotion		0.86 (0.61-1.22)
Conduct		1.79* (1.09-2.95)
Peers		1.67** (1.17-2.38)

* significant at < .05
** significant at < .01

10.3.4 Attachment as a moderator

As anxious attachment was not significantly associated with NSSI, only the moderating effects of avoidant attachment were examined in order to limit the number of analyses being conducted. No moderations were significant at T1 (all $p > .190$), at T2 (all $p > .260$), or prospectively with T1 predictors of T2 NSSI (all $p > .140$).



*. p > .05
**. p > .01
***. p > .001

The model displays standardized coefficients of the direct effects of CFA and mediators on NSSI; and the indirect effects (95% confidence intervals) of CFA on NSSI through each of the mediators (down the centre of the figure). Significant effects ($p < 0.05$) are shown in bold with solid lines.

Figure 10.2. Path diagram of the multiple mediation model of the effect of avoidant attachment on NSSI through adjustment (prosocial, hyperactive, and conduct).

10.4 Discussion

I found evidence to support my hypotheses that poor adjustment and insecure attachment are associated with NSSI in early adolescence, and that adjustment factors mediate the association between insecure attachment and NSSI. While conduct problems were associated with NSSI at both T1 and T2, hyperactivity was significantly more strongly associated with NSSI at T1 than T2, and emotion problems were only associated with

NSSI at T2. While there is a large body of research demonstrating that emotional problems are central to NSSI among older adolescents (Nixon et al., 2008; Selby et al., 2012), an emerging body of research on young adolescents has indicated that behavioural problems are more salient to NSSI than emotional problems in this younger age group using both the SDQ (Lundh et al., 2011) and other instruments (Lundh et al., 2007; Sourander et al., 2006). These differences in correlates of NSSI across age groups may indicate that NSSI among young adolescents is more a symptom of behavioural difficulties whereas among older adolescents it is a more response to emotional problems. This possibility highlights the need for a cohort study of the time-variant effect of emotional and behavioural problems on NSSI. The present findings, however, suggest that behavioural difficulties among children may be a target for NSSI treatment and intervention.

Conduct and peer problems at T1 were both significantly predictive of new NSSI by T2. The link between conduct problems and NSSI seems to be robust in this sample, both cross-sectionally and prospectively. In a different study of a community sample of 13-15 year olds, the conduct subscale of the SDQ was found to be the only subscale that was significantly predictive of new self-harm a year later (Lundh, Wångby-Lundh, & Bjärehed, 2011). It is interesting that in the present study peer problems were also prospectively associated with NSSI as they were not cross-sectionally associated with NSSI at either T1 or T2. This may be a type I error. Nevertheless, the present prospective findings add further support to the idea that NSSI among younger children is more a symptom of behavioural or externalising difficulties whereas among older children and adolescents NSSI is more closely associated with emotional problems and psychological distress.

Avoidant attachment was cross-sectionally associated with NSSI at T1, but anxious attachment was not. Both avoidant and anxious attachment have been previously linked to NSSI (Gormley & McNiel, 2010), however one study of a slightly older sample of adolescents found the opposite pattern from the present study; attachment anxiety and not avoidance was indirectly associated with BPD symptoms including self-harm (Scott, Levy, & Pincus, 2009). The present findings may suggest that among children, feeling

distant from parents is more deleterious than being unsure about the security of the parent-child relationship.

As attachment was not prospectively associated with NSSI, I could only test potential mediation models with cross-sectional data. This poses an issue for determining causation. It is possible therefore that either behavioural problems or NSSI actually impair attachment. Thus impaired attachment may mediate the behavioural problems-NSSI association, or NSSI may mediate the attachment-behavioural problems association. However these potential alternative models seem less plausible than the one tested, in which the attachment-NSSI association is mediated by behavioural problems among young adolescents, indicating NSSI may arise as a symptom of the behavioural problems associated with insecure attachment. Children with avoidant attachment styles may fail to learn effective inhibitory control, leading to hyperactivity and conduct problems (Clarke, Ungerer, Chahoud, Johnson, & Stiefel, 2002), which are in turn related to NSSI (Izutsu et al., 2006; Hinshaw et al, 2012). This proposed model is supported by cross-sectional findings suggesting that the link between insecure attachment and borderline personality disorder symptoms (including NSSI) is mediated by deficits in impulse control (Scott, Levy, & Pincus, 2009; Fossati, Feeney, Carretta, & Grazioli, 2005). The pathway has yet to be demonstrated with longitudinal data for NSSI specifically.

The significant gender by prosocial interaction at T2 showed that low prosocial behaviour was significantly associated with NSSI for girls but not boys. In general early adolescent girls tend to display more prosocial behaviour than their male peers, with this difference becoming more pronounced with older age (Fabes, Carlo, Kupanoff, & Laible, 1999). It may be, therefore, that a lack of prosocial behaviour among girls is associated with or indicative of poor adjustment, whereas among boys a lack of prosocial behaviour is normal. This finding, as far as I know, is novel and warrants further investigation.

The finding that only one indicator of SES (parent employment) was associated with NSSI, and only at T2, is in keeping with previous findings that NSSI is not strongly

correlated with SES (Hilt, Nock, Lloyd-Richardson, & Prinstein, 2008), but has been associated with lower levels of education among adolescents (Brunner et al., 2007).

No moderations with attachment were significant, meaning I once more found no evidence that secure attachment acts as a protective factor against the effects of emotional or behavioural adjustment on NSSI.

10.4.1 Clinical implications

The present findings suggest that conduct problems may be a significant risk factor for NSSI among children. Thus, behavioural difficulties among children may be both a warning sign for NSSI and a target for NSSI treatment and intervention. The efficacy of therapy aimed at reducing NSSI among children by addressing hyperactivity and conduct problems should be explored with randomised control trials.

Findings also provide further evidence that insecure attachment, specifically avoidant attachment, is associated with NSSI, although I did not find a prospective link. Thus, avoidant attachment may be a risk factor, symptom, or correlate, of NSSI among young adolescents. Nevertheless, as insecure attachment is associated with hyperactivity and conduct problems (Clarke, Ungerer, Chahoud, Johnson, & Stiefel, 2002), which are in turn related to NSSI in both the present study and others (Izutsu et al., 2006; Hinshaw et al, 2012), improving avoidant attachment may be an effective means of ameliorating these behavioural problems and thereby reducing the risk of NSSI. This model is supported by the present cross-sectional findings that the association between avoidant attachment and NSSI at T1 is mediated by hyperactivity and conduct problems. Attachment focused therapy is effective at reducing both conduct and hyperactivity problems among children and adolescents (Moretti, Holland, & Peterson, 1994), and may therefore be an effective treatment for NSSI among young adolescents.

10.4.2 Limitations

Although the present sample was larger than most previous studies of NSSI with this young age group, low rates of NSSI (16 participants at T1 and 26 at T2) limited power. Another shortcoming of this study is the use of a single-item measure of NSSI, which

fails to capture information about severity, frequency, or type of NSSI. This is potentially problematic as different methods and frequencies of NSSI have been related to different psychological and environmental factors (Rodham et al., 2004). However, with a sample size of 559, I would not have had sufficient power for mediation/moderation analyses if I had split the primary outcome variable.

Finally, I did not find a significant prospective link between attachment and NSSI, meaning the assumptions of directionality on which the mediation model was based are not definitive. Moreover, attachment was only measured at Time 1, limiting my ability to draw conclusions of causality. Therefore, while poor adjustment may be a result of insecure attachment, it is also possible that insecure attachment is at least partially a consequence of poor adjustment - distressed children and impulsive children are also more difficult to parent (Johnston & Mash, 2001). Research with three waves is needed to confirm the temporality of associations between these factors and NSSI. A further limitation is that 32% of the sample did not provide follow-up data, however analysis suggests that baseline variables did not predict attrition and as such results are likely to be generalizable across the initial sample.

Despite these shortcomings, the current study suggests that one possibly pathway for the attachment-NSSI association is through behavioural problems, highlighting the important role of behavioural problems in the aetiology of NSSI among young adolescents.

10.5 Conclusion

In this chapter I demonstrated that conduct problems, hyperactivity, and avoidant attachment at age 13 and conduct and emotion problems at age 14 were correlated with NSSI. Moreover, conduct and peer problems at age 13 were predictive of new NSSI by age 14. Finally, cross-sectional analyses at age 13 indicated that the association between avoidant attachment and NSSI may be mediated by hyperactivity and conduct problems. These findings suggest interventions to improve externalizing problems, in particular conduct problems, may reduce NSSI among young adolescents. Attachment focused

therapies may be effective at reducing child NSSI either directly, or by improving hyperactivity and conduct problems.

Chapter 11

General discussion

In this chapter I summarize key findings from the studies presented in this dissertation, followed by a brief discussion of themes common across multiple chapters, such as the important role of child-parent relationships, the predominant influence of child-parent over child-peer relationships, and trends with gender and age. Finally, I suggest viable directions for future research.

11.1 Summary of key findings

In this dissertation I investigated factors associated with non-suicidal self-injury (NSSI) among youth, with a particular focus on the role of child-parent relationships. Using data from multiple large datasets I was able to identify proximal risk factors such as family dysfunction and psychological distress as well as indirect pathways from more distal factors such as childhood trauma to NSSI.

Using longitudinal data from a community sample (Roots) of 933 adolescents with no history of NSSI, I demonstrated that the association between childhood family adversity before age 5 and new onset of NSSI by age 17 was mediated by family functioning and mental illness at 14. These findings suggest that improving the family environment may mitigate the effects of CFA on adolescent onset of NSSI.

Using longitudinal data from a sample (NSPN) of 1489 community-recruited adolescents (ages 14-25), I showed that distress and impulsivity had bi-directional associations with NSSI, highlighting the importance of carefully controlled prospective studies involving these factors. I also showed that poor child-parent relationships appear to be an unequivocal prospective risk factor for NSSI, in support of models in which family dysfunction is a risk factor for and not a consequence of NSSI.

Using a sub-sample (n = 1208) of the NSPN sample that reported never having engaged in NSSI at baseline, I demonstrated that the prospective parenting-NSSI association was mediated by psychological distress, and that impulsivity was independently predictive of NSSI. These findings indicate that positive parenting may reduce risk of NSSI through its effect on reducing psychological distress. Impulsivity is also implicated as a potential treatment target for NSSI.

Using cross-sectional data I collected myself from a community sample (SHARE) of 596 adolescents (ages 16-19), I demonstrated that the attachment-NSSI association was mediated by psychological distress, and the trauma-NSSI association was mediated by attachment and distress. Impulsivity, specifically negative urgency, was once again uniquely associated with NSSI. Thus, the individual pathways to NSSI identified in the

previous studies were reaffirmed together in this one sample. Further, I demonstrated that secure attachment in the form of low alienation moderated the trauma-NSSI association, indicating that secure attachment may act as a protective factor.

Finally, using data from a sample (JOnG!) of 559 community-recruited Flemish 13 year-old students I demonstrated that conduct problems, hyperactivity, and avoidant attachment at age 13 and conduct and emotion problems at age 14 were correlated with NSSI among this younger population. Cross-sectional analyses at age 13 also indicated that the attachment-NSSI association might be mediated by hyperactivity and conduct problems. These findings suggest behavioural problems may more salient to NSSI than are emotional problems among young adolescents.

In addition to the above research on risk factors and correlates of NSSI among young people, I also demonstrated the validity and utility of two new measures relevant to the study of NSSI, the Youth Trauma Scale (YTS) and the Positive Parenting Questionnaire (PPQ). I showed the YTS to be a comprehensive and psychometrically valid measure of early traumatic experiences, redressing a gap in the existing body of available measures. Likewise, the PPQ is a psychometrically sound, reliable, and valid measure of positive parenting, redressing the predominant focus of existing instruments on family dysfunction and poor child-parent relationships.

11.2 Clinical implications

Findings from SHARE and Roots are consistent with a large amount of pre-existing literature demonstrating that trauma is a robust risk factor for adolescent NSSI (Maniglio, 2011). Reducing trauma, therefore, is likely to reduce NSSI. However, findings from SHARE and Roots expand upon prior work by testing more comprehensive models than previously reported (Fliege et al., 2009; Maniglio, 2011), giving clearer insight into ways to reduce the adverse sequelae of trauma. First, treating psychological distress resulting from either trauma or insecure attachment is likely an effective way of reducing the risk for NSSI among adolescents, in keeping with current treatment guidelines (NICE

National Collaborating Centre for Mental Health (UK), 2012). Second, improving child-parent relationships may reduce distress and thereby lower the risk for NSSI.

Findings from SHARE, Roots, and NSPN demonstrating the important role of child-parent relationships in the aetiology of NSSI support a family-focused approach to preventing adolescent NSSI. One such approach, Attachment Based Family Therapy (ABFT) (Diamond, Reis, Diamond, Siqueland, & Isaacs, 2002), which focuses on improving communication and support in child-parent relationships, has been shown to be effective among adolescents at reducing both depression and suicidality (Diamond et al., 2010). As depression and suicidality are both closely related to NSSI (P. O. Wilkinson et al., 2011), the efficacy of ABFT on reducing the risk of NSSI seems theoretically promising and should be investigated with larger randomized control trials. One such study, the *Self-Harm Intervention: Family Therapy* (SHIFT) trial, is currently underway with a sample of 11 to 17 year olds in the UK (Wright-Hughes et al., 2015). Not only do strong child-parent relationships appear to be proximally associated with lower rates of NSSI (Chapters 5 and 6), but they also mediate the association between childhood trauma and NSSI (Chapters 3 and 9), and moderate the trauma-NSSI association (Chapter 10).

Findings from both NSPN and SHARE demonstrating the unique role of impulsivity in NSSI onset implicate impulsivity as a potential target for NSSI treatment and prevention. Addressing impulsivity problems (for example through psychological training or medication that reduces impulsivity) may be an effective means of lowering the risk of NSSI or even of treating recurrent NSSI among young people.

Finally, findings from JOnG! indicate that behavioural problems may be more salient to NSSI than are emotional problems among young adolescents, implicating behavioural problems as a potential target for NSSI treatment and intervention among this young age group.

In sum, trauma, psychological distress, child-parent attachment, and impulsivity are all risk factors for NSSI, and distress and attachment may also be potentially useful areas of therapeutic focus for reducing the risk of NSSI conferred by trauma.

11.3 Peers

Across studies a general trend emerged in which child-parent relationships appeared to be more influential than peer relationships in regards to NSSI, in keeping with a substantial body of literature (Fotti et al., 2006; Hallab & Covic, 2010). In the NSPN and Roots samples, peer relationships were not a unique predictor of new onset of NSSI, whereas child-parent relationships were. Only in SHARE were both parent and peer attachment associated with NSSI, however these analyses were cross-sectional. In addition, in none of the studies did peer relationships moderate the effect of poor child-parent relationships or other risk factors for NSSI. Thus as well as having no direct prospective effects on NSSI, peer relationships did not mitigate the effects of other risk factors (for example young people with poor family functioning will be at increased risk of NSSI, whether or not they have positive peer relationships).

There are several possibly reasons why child-parent relationships might be a stronger predictor of NSSI than peer relationships during adolescence. Firstly, as family relationships typically predate peer relationships, the former exert influence over the latter (van Harmelen et al., 2016). Thus, some of the observed association between peer relationships and NSSI may actually be accounted for by the correlation between children's parent and peer relationships (Pallini et al., 2014). Early child-parent relationships also influence numerous developmental trajectories that may be risk factors for subsequent NSSI, such as affect regulation and stress response (Cozolino, 2014; DeKlyen & Greenberg, 2008; Schore, 2001a). These traits are relatively well established and inflexible by adolescence, and may be unaffected by peer relationships. In addition, in the present dissertation, family and peer relationships were measured while participants were generally still in adolescence and may therefore have only just begun to move away from reliance on parents. It is possible that as adolescents transition into young-adulthood, families become less influential over NSSI relative to peers. This possibility highlights the need for a cohort study of the time-variant effect of parent and peer relationships on NSSI.

11.4 Gender and age

The existing literature on gender differences in rates of NSSI is mixed. Many early studies found that NSSI is more common in females, however a recent meta-analysis showed that gender differences disappear when methodological differences are taken into consideration (Swannell et al., 2014); namely the inclusion of more 'male-type' NSSI. Too narrow a definition of NSSI, namely cutting and poisoning, may lead to a gender bias in some studies as girls are more likely to engage in these behaviours whereas boys are be more likely to engage in often-overlooked forms of NSSI such as punching oneself or other objects (Swannell et al., 2014; B. Taylor, 2003). Swanell and colleagues also propose that the concept of NSSI as a primarily female behaviour may stem from early studies of clinical inpatient populations in which a disproportionate number of borderline personality disorder patients may have been present (Graff & Mallin, 1967; Rosenthal, Rinzler, Wallsh, & Klausner, 1972). As NSSI is a key feature of BPD, which in turn is more common among females, this may have biased early perceptions. A number of recent studies have nevertheless found higher rates of NSSI among girls, even in large non-clinical populations using broad definitions of NSSI (Brunner et al., 2007; Laye-Gindhu & Schonert-Reichl, 2005).

Findings in regards to gender and NSSI in this dissertation were also mixed. In the Roots sample gender was not associated with new onset of NSSI from age 14-17. Female gender was, however associated with higher rates of NSSI at baseline (age 14), but as prior history of NSSI was an exclusion criterion for the analyses presented in Chapter 3, these participants were not included in further study. Nevertheless, the unrestricted Roots sample may have contained more females than males who engaged in NSSI between the ages of 14 and 17 overall. In SHARE there was a graded association between NSSI and gender, where rates were higher in 'other' gender > female > male for both lifetime and recent NSSI. Age (16-18) was not associated with NSSI and there was no significant age by gender interaction. Likewise, in the NSPN sample, girls were significantly more likely than boys to report having engaged in NSSI over the past year at the time 2 follow up. Although there was no significant main effect of age (14-25), the age by gender interaction was significant. Boys were more likely to report NSSI if they were older,

whereas NSSI among girls was not associated with age. Following a similar trend, in the JOnG! sample, female gender was associated with higher rates of NSSI but only at age 14, not at age 13, although the age by gender interaction was non-significant. This emergence of a gender difference may coincide with the onset of puberty, in keeping with the idea that gender differences in NSSI may be due to different ages of development (G. C. Patton et al., 2007). Girls mature both physically and psychologically earlier than boys, and consequently experience psychopathology earlier as well (Ge, Conger, & Elder, 2001). Thus, gender differences may become pronounced in early-mid adolescence when a significantly greater proportion of girls than boys have begun puberty. In earlier adolescence, when few children of either gender have begun puberty, and in later adolescence and young adulthood when most people of either gender have either entered or finished puberty, rates of NSSI may be similar across genders. Indeed, while rates of NSSI among older adolescents and young adults seem to be even across genders (Swannell et al., 2014), several other studies of under 16 year olds have found significantly higher rates among girls than boys in both clinical and community samples (Hawton & Harriss, 2008; Madge et al., 2008; Vajani et al., 2007). Likewise, the systematic review conducted by Fliege and colleagues (2009), found that in studies of young adults and adults there were no observed gender differences in NSSI rates, whereas in six out of the seven adolescent samples they reviewed, rates of NSSI were higher among girls. Thus, mixed findings in both the present dissertation and the field at large in regards to gender differences in NSSI might be in part a result of age differences across samples and pubertal development. This theory is, however, as yet unproven and opinion on gender differences in NSSI rates is divided. A longitudinal cohort study of pubertal development and NSSI could help clarify this issue and resolve apparent differences across studies in regards to gender and NSSI.

The gender difference observed in the NSPN, JOnG!, and SHARE samples may also be due to the fact that only a single broadly worded item was used to assess NSSI as opposed to a multi-item inventory. The latter yields higher and presumably more accurate prevalence rates (Swannell et al., 2014), possibly by prompting people to recall or consider incidents of those less traditional forms of NSSI more typically performed by

males. However, a single item was also used in Roots and gender differences were observed. Therefore, the present findings that more girls than boys reported engaging in NSSI in several samples supports a position that was formerly widely accepted but has recently been disputed.

11.5 Limitations and future directions

In addition to cohort studies of the time-variant effects of parent and peer relationships, and gender and pubertal development on NSSI there are several other viable areas of future research indicated by findings from this dissertation.

One shortcoming of the research presented in this dissertation is that none of it was based on datasets with more than two time points. Thus, although the temporal relationships between proposed risk factors was investigated in Chapter 5, it is possible that trends observed between distal risk factors and proposed mediators were not the same prior to baseline data collection. The only way to unequivocally demonstrate mediation pathways would be to run analyses on datasets with three or more time points. Steps were, however, taken to control for the possibility of reverse causality in regards to the primary outcome variable, NSSI: prior engagement in NSSI was controlled for in Chapters 5 and 10; the samples in Chapters 3 and 6 were restricted to participants without former histories of NSSI; and comparisons in Chapter 9 were made between participants with no histories of NSSI versus those who had engaged in NSSI within the past month. Thus, although we cannot be sure about the relationships between identified risk factors, we can nevertheless be confident that they are indeed prospective risk factors for NSSI.

An additional limitation of the research presented throughout this thesis is that none of the analyses controlled for current mood as a potential confound to results. This is problematic because current mood could influence reporting both of recent NSSI, more general mood, and child-parent relationships, as well as recall of more distant risk factors such as childhood trauma (Schraedley, Turner, & Gotlib, 2002). Thus, although the questionnaire measures of mood used in Chapters 3 and 9 were for the most part designed

to assess mood more proximally than trauma, because assessment of both trauma and mood happened contemporaneously it is impossible to know that current mood did not confound retrospective recall. In general, recall of traumatic events is both accurate and resilient to the influences of psychological illness and distress (Brewin, Andrews, & Gotlib, 1993), however more robust research going forward could use a three wave data collection design and control for the effects of current mood.

Likewise, only two studies presented in this thesis (Chapters 3 and 10) examined the effects of socioeconomic status (SES) on NSSI and only Chapter 3 controlled for the effects of SES on NSSI. Although SES is strongly associated with a constellation of environmental and developmental factors (Bradley & Corwyn, 2002) it is weakly associated with NSSI (Hilt, Nock, Lloyd-Richardson, & Prinstein, 2008). Findings from this these that only one measure of SES (parent employment in Chapter 10) was associated with NSSI and only at one of two time points further indicates that SES is not likely an important confound of NSSI research.

Another limitation of the research presented in this dissertation is that different types of NSSI were not investigated independently. Adolescents engage in a broad range of NSSI, and different forms of NSSI have been linked to different demographic, and psychological factors (Rodham et al., 2004; Swannell et al., 2014; B. Taylor, 2003). Although much of the data presented in this dissertation was derived from large samples, numbers were nevertheless insufficient to support splitting the primary outcome variable, NSSI, by type. Moreover, the primary focus of this dissertation was on identifying prospective risk factors, pathways, and correlates of NSSI, not exploring differences between types of NSSI. Although I did demonstrate that my most commonly used measure of NSSI (DASI) was adequately correlated with a multi-item inventory of NSSI (SHI), an interesting area of future research would be identifying differential risk factors and correlates of specific types of NSSI.

One further limitation of this dissertation is that paternal and maternal attachment were never investigated independently. Although mother and father attachment are highly correlated (Fox, Kimmerly, & Schafer, 1991), there is some evidence suggesting that

paternal attachment is more strongly associated with NSSI than maternal attachment (Hallab & Covic, 2010). Having repeatedly demonstrated the key role of child-parent relationship dysfunction as a risk factor for NSSI in this dissertation, it would be interesting to compare the distinct effects of dysfunctional maternal and paternal child-parent relationships on adolescent NSSI. This could be accomplished by having a non-clinical sample of adolescents complete an unpublished adaptation of the Inventory of Parent and Peer Attachment (Armsden & Greenberg, 1987), which assesses maternal and paternal attachment separately. Findings could inform the focus of family centred therapies for adolescent NSSI.

Another area for future research indicated by findings from this dissertation is the association between NSSI and neuropsychological measures of impulsivity. This is an important step as self-report measures may not equate to real world behaviour. Prior attempts at demonstrating a link between NSSI and behavioural measures of impulsivity have been for the most part unsuccessful (Hamza et al., 2015), although one meta-analysis detected an effect across studies (Liu et al., 2017). These attempts, however, used measures of general impulsivity, whereas results from the SHARE study indicated that only impulsivity in the context of negative emotions is robustly associated with NSSI. Having demonstrated a longitudinal prospective link between self-reported impulsivity and heightened risk for NSSI, it would be interesting to show that a behavioural measure of impulsivity in the context of negative emotions is also associated with adolescent NSSI. One study has done so, using an affective stop-signal task in which participants were randomly signalled to inhibit a key-press response after exposure to positive, negative, and self-harm related stimuli (K. J. D. Allen & Hooley, 2015). This study was not only the first to examine NSSI and behavioural impulsivity using emotionally valenced stimuli, but was also the first and only to detect an association between NSSI and a neuropsychological measure of impulsivity; participants with histories of NSSI demonstrated greater impulsivity than controls in response to negative emotional stimuli, and better inhibitory control in response to self-harm stimuli. This unique study supports the idea that NSSI is associated not only with self-reported impulsivity, but also with behavioural impulsivity in response to emotional content.

Another possible means of testing the above theory would be by having participants complete a computerised affective go/no-go task, which measures impulsivity and inhibitory control in relation to emotionally valenced stimuli (Drevets & Raichle, 1998). The task involves participants responding as quickly as possible with a key press only when presented with a stimulus (word or image) of a particular emotional valence (e.g. positive, neutral, negative). Participants complete several trials, responding to stimuli of a different valence each trial. Response times and errors provide information about the participant's general inhibitory control, and performance in relation to cues of different valence provides information about whether certain emotional stimuli are more difficult for participants to inhibit or ignore. Participants would also complete self-report measures of impulsivity, psychological distress, and NSSI. In keeping with findings from SHARE in which only Negative Urgency was associated with NSSI, I expect that negatively valenced stimuli will be more distracting to participants who engage in NSSI than neutral stimuli. Findings could pave the way for extant interventions aimed at improving impulse control to be adapted for treating and preventing adolescent NSSI.

11.6 Conclusions

Analyses of multiple large samples of adolescents and young adults indicated that childhood trauma, poor child-parent relationships, and psychological distress were robust risk factors for NSSI. Moreover, family dysfunction and psychological distress appear to mediate the trauma-NSSI association, and distress appears to mediate the association between poor child-parent relationships and NSSI. Thus both distress and child-parent relationships may be viable targets for intervention to reduce rates of NSSI among young people, and to attenuate the impact of early childhood trauma. Among young adolescents, behavioural problems may be particularly relevant to NSSI as both a warning sign and a target for intervention, even more so than emotional problems.

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Appendix A

Full case analyses from Chapter 3

A.1 Univariate associations with NSSI and CFA

Table A1. demonstrates univariate associations between our predictor variables and new onset of NSSI between the ages of 14 and 17. Poorer family functioning at age 14 and mental illness up to the age of 14 were positively associated with new onset of NSSI between ages 14 and 17. Friendships were not associated with NSSI, neither was SES. Gender was not associated with new onset of NSSI from ages 14-17 (male new incidence=0.05%, female new incidence=0.07%, $\chi 2=1.06$, p=0.35). Although CFA was non-significantly associated with NSSI in univariate analyses (p = 0.06) it was retained for multivariate analyses as a key variable of interest.

Table A2 shows correlations between our predictor variables and CFA. Poorer family functioning at 14 and mental illness up to 14 were positively correlated with CFA and new NSSI. Therefore family functioning and mental illness are potential mediators for the CFA-NSSI association. Family functioning and mental illness were reasonably uncorrelated with each other (r = -0.12) and had low variance inflation factors (mean variance inflation factor = 1.15), suggesting that multicollinearity was not an issue in our model.

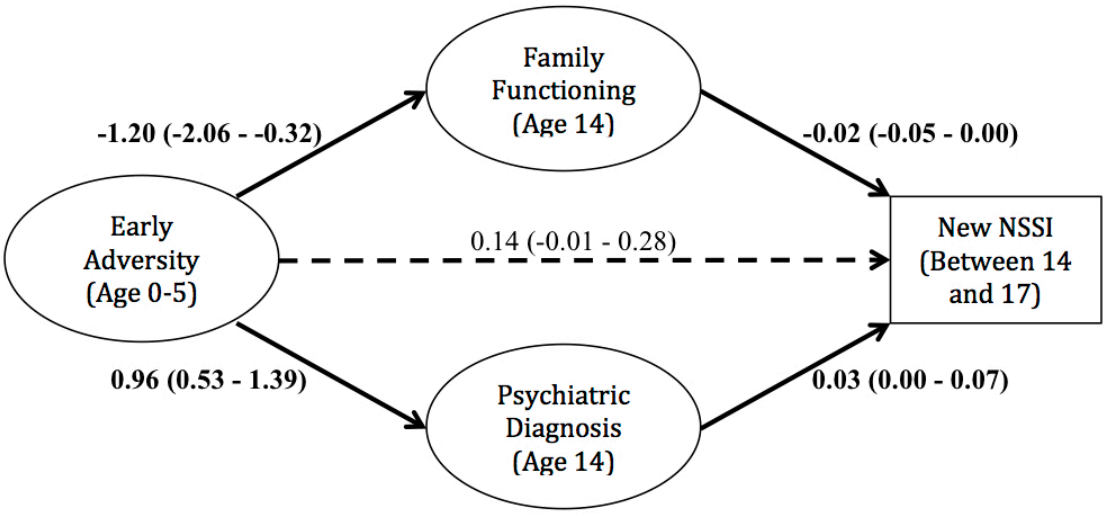
Table A1
Correlations between new NSSI from ages 14-17, CFA, and potential mediator and explanatory variables measured at the age of 14

		New Onset of NSSI		CFA	
	n	r	*p*	r	*p*
CFA	903	0.16	0.063		
Gender	935	-0.08	0.346	0.05	0.336
DSM diagnosis	931	0.19	0.043	0.32	< 0.001
SES	935	-0.01	0.986	0.16	< 0.001
Family functioning	814	-0.10	0.005	-0.10	0.007
Friendships	825	-0.05	0.173	-0.07	0.030

n refers to number of participants with data for both the risk factor and new onset of NSSI. r statistics represent tetrachoric correlations for CFA, gender, DSM diagnosis, and SES, and point-biserial correlations for family functioning and friendships.

A2. Revealing a psychosocial model for 1st episode NSSI

For the multiple mediation model, only participants without missing data on any of the variables used were included; N = 783. Results of the binary logistic multiple mediation analysis are shown in Figure A1. In this smaller sample of participants, CFA was significantly predictive of new onset NSSI in univariate analyses (beta = .79, p = 0.01). Mental illness and family functioning significantly mediated the association between CFA and NSSI. The direct pathway between CFA and NSSI was non-significant. This model accounted for 19% of the variance in new onset of NSSI between aged 14 and 17. Friendships and family functioning did not significantly moderate the effects of CFA or mental illness on NSSI, nor did friendships moderate the effects of family functioning on NSSI (all p > 0.2).



The model displays standardized coefficients (95% confidence intervals) of the direct effects of CFA on NSSI and the mediators; and the indirect effects of CFA on NSSI through each of the mediators (the three coefficients at the right of the figure). Significant effects ($p < 0.05$) are shown in bold with solid lines.

Figure A1. Path diagram of the multiple mediation model of the effect of CFA on new onset of NSSI through mental diagnosis and family functioning.

Appendix B

Full case analyses from Chapter 6

B1. Univariate predictors of NSSI

Girls were significantly more likely than boys to report engaging in NSSI within the past year at T2 (beta = 0.57, z = -2.11, p = 0.035). There was a significant effect of age (beta = -0.13, z = -2.97, p = 0.003), with older participants being less likely to report having engaged in NSSI over the past year at T2. The age by gender interaction was not significant (beta = 0.07, z = 0.77, p = 0.441). Because gender and age were significantly related to new onset of NSSI they were controlled for as potential confounds in all further analyses.

Table B1 shows that lack of positive parenting, greater general distress, and all BIS impulsivity subscales at T1 were significantly correlated (all $p < 0.02$) with new onset of NSSI at T2, controlling for gender and age. As all three BIS subscales were significantly correlated with NSSI, only the total score will be used in analyses henceforth to limit the number of tests being conducted.

B2. Directions of relationships between risk factors for NSSI

Cross-lagged analyses showed that lack of positive parenting at T1 predicted general distress at T2 and not the reverse (Figure B1a). As such, general distress can be entered as a potential mediator between parenting and NSSI in the subsequent mediation analysis.

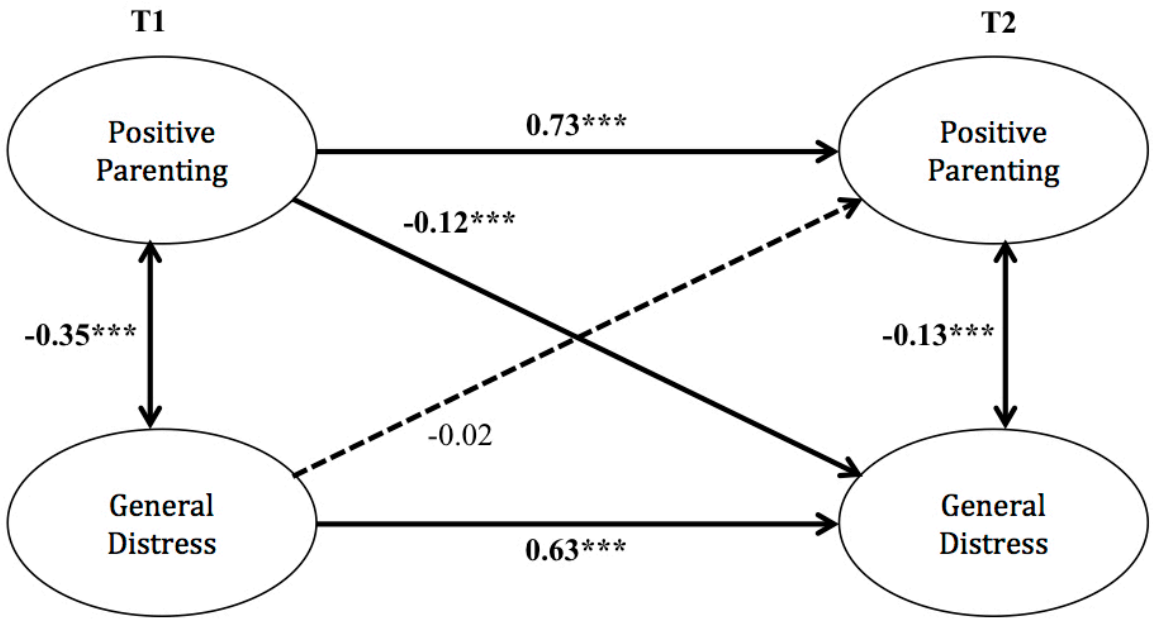
Cross-lagged analyses with positive parenting and impulsivity showed that neither variable at T1 significantly predicted the other at T2 (Figure B1b). Therefore, impulsivity should be entered as a covariate (at the same level as positive parenting) in the subsequent mediation analysis

Table B1
Point-biserial correlations with new NSSI at T2

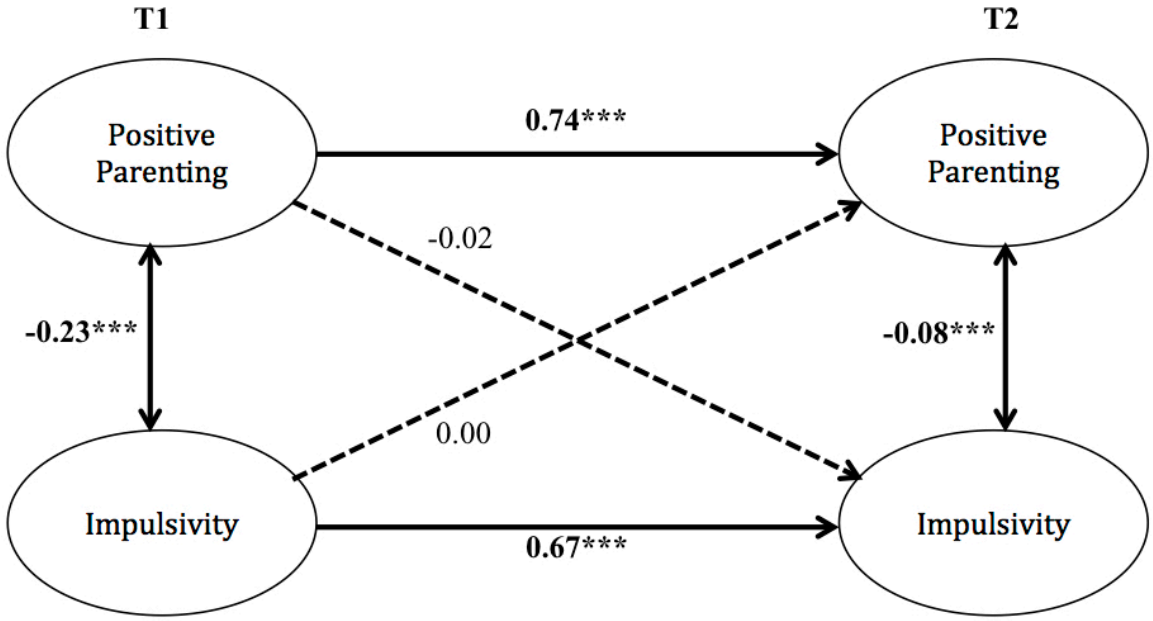
	r	p
Positive parenting	-0.11	0.000
General distress	0.13	0.000
BIS Attention	0.11	0.000
BIS Motor	0.07	0.019
BIS Non-planning	0.08	0.009
BIS Total	0.12	0.000

BIS Barratt Impulsiveness Scale
Controlling for gender and age

B1a.



B1b.



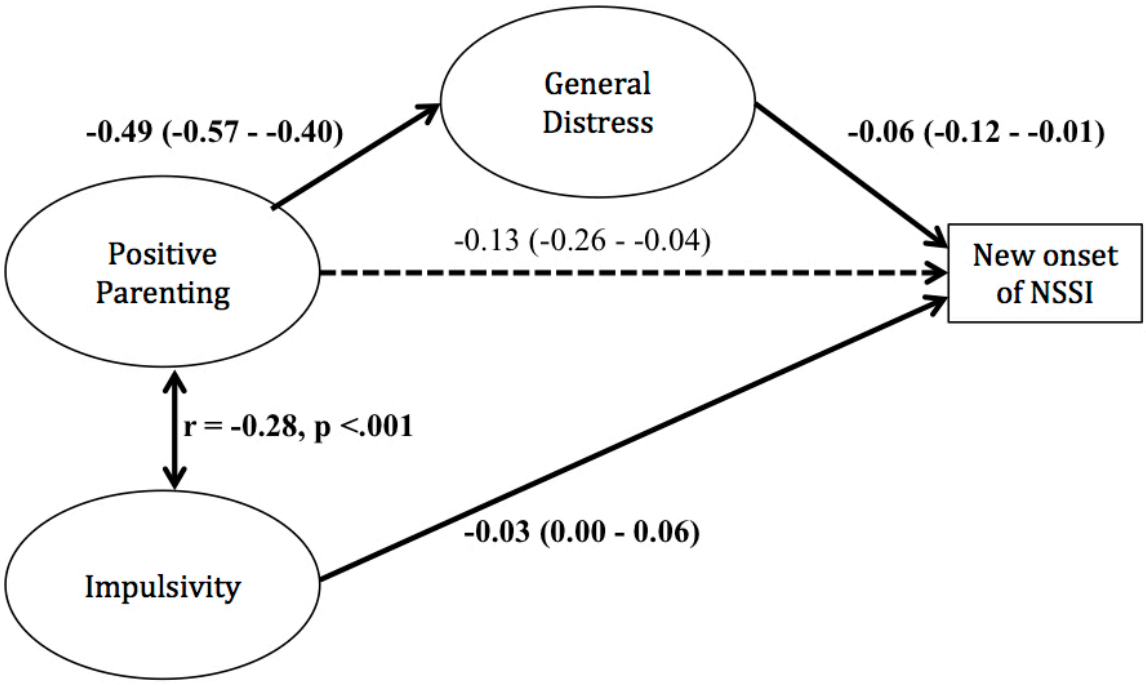
***. Correlation significant at p > .001.

The model displays standardized coefficients of the effects of positive parenting and general distress/impulsivity at T1 on positive parenting and general distress/impulsivity at T2 controlling for their mutual effects. Pathways significant at $p < 0.05$ are shown with a solid line with coefficients in bold.

Figure B1. Path diagram of the cross-lagged analyses of the effect of positive parenting and general distress/impulsivity at T1 on positive parenting and general distress at T2 controlling for their mutual effects.

B3. Revealing a psychosocial model for new onset of NSSI

Results of the binary logistic multiple mediation analysis are shown in Figure B2. The indirect effect of positive parenting through reduced general distress and subsequent lower rates of NSSI was significant. The direct effect of positive parenting on NSSI was no longer significant. Impulsivity (beta = 0.03, p = .039), gender (beta = -0.62, p = 0.029), and age (beta = -0.16, p = 0.001), were additional significant independent predictors of new onset of NSSI.



The model displays standardized coefficients (95% confidence intervals) of the direct effects of positive parenting on NSSI and general distress; and the indirect effect (with bias-corrected 95% confidence intervals) of positive parenting on NSSI through general distress (the coefficient at the right of the figure) all controlling for the independent effects of gender, age, and impulsivity. The effect of impulsivity on NSSI as a covariate is also shown as a variable of particular interest, as is the Pearson correlation between impulsivity and positive parenting. Pathways significant at $p < 0.05$ are shown with a solid line with coefficients in bold.

Figure B2. Path diagram of the multiple mediation model of the effect of parenting on new onset of NSSI through general distress and impulsivity.

B4. Moderation effects

The interaction terms between the impulsivity scales and general distress in predicting later NSSI were all non-significant (all $p > 0.78$). The interaction terms between positive parenting and general distress, impulsivity, gender, and age in predicting later NSSI were likewise all non-significant (all $p > 0.10$).